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Wild Neighbors : The Humane Approach to Living with Wildlife

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The Humane Society of the United States

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Recommended Citation
Hadidian, J., & Baird, M. (2007). Wild neighbors: The humane approach to living with wildlife. Washington, D.C: Humane Society Press.

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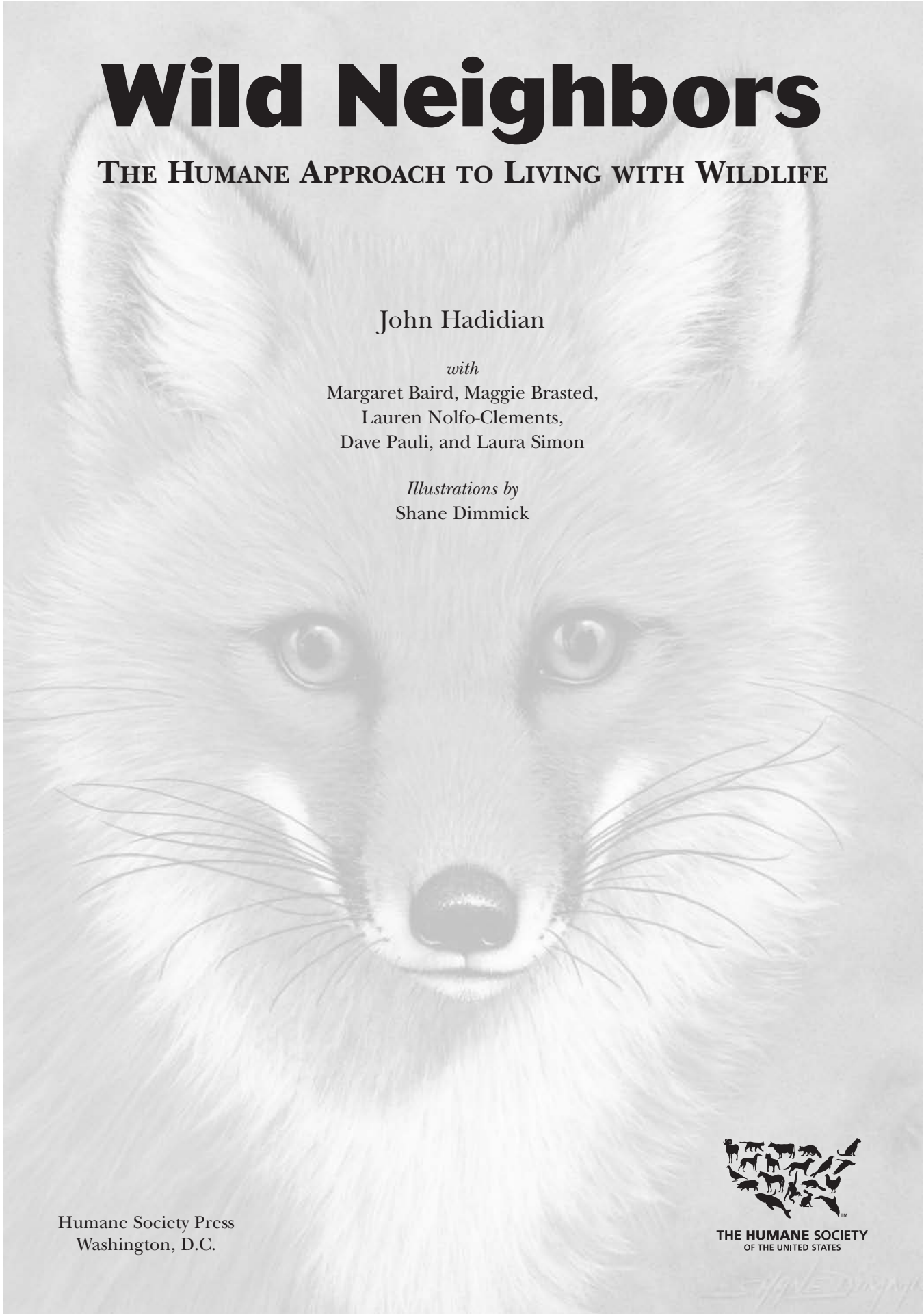
Wild Neighbors

The Humane Approach to Living with Wildlife

John Hadidian

with
Margaret Baird, Maggie Brasted,
Lauren Nolfo-Clements,
Dave Pauli, and Laura Simon

Illustrations by
Shane Dimmick



Humane Society Press
Washington, D.C.

THE HUMANE SOCIETY
OF THE UNITED STATES

John Hadidian, Margaret Baird, Maggie Brasted, Lauren Nolfo-Clements, Dave Pauli, and **Laura Simon** are on the staff of The Humane Society of the United States.

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This book challenges people to enjoy wildlife in its natural beauty and live with it as humanely as possible. Nonetheless, there is always a possibility of injury, even serious injury, when people try to solve wildlife problems. Wild animals can be dangerous if contacted or handled improperly, and the procedures and products used to control wildlife problems humanely can be dangerous if the individual does not take proper precautions. Neither the authors nor The Humane Society of the United States assume any liability for any injury or property damage that may result from the use of this book.

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Second edition

ISBN 0-9748400-8-4

Library of Congress Cataloging-in-Publication Data

Hadidian, John.
Wild neighbors : the humane approach to living with wildlife /
John Hadidian ; with Margaret Baird ... [et al]. — 2nd ed.
p. cm.
Rev. ed. of: Wild neighbors / Humane Society of the United States.
Golden, Colo. : Fulcrum Pub., c1997.
Includes index.
ISBN 0-9748400-8-4
1. Urban pests—Control. 2. Wildlife pests—Control. 3. Animal welfare.
4. Urban animals—Identification. I. Baird, Margaret. II. Wild neighbors. III. Title.
SB603.3.W45 2007
628.9'6091732—dc22
2007011618

100% recycled post-consumer paper, certified Ecologo, processed chlorine free, with soy-based ink, FSC certified and manufactured using biogas energy.

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Foreword

Most Americans live in urban or suburban environments, and the wild animals in our communities enrich our lives and represent a vital link to the natural world. Yet, our residential and commercial developments, roads, and modes of transportation often have life-threatening effects on these creatures.

Drivers inadvertently kill countless millions of wild animals on our roads every year. Developers knock down trees and disrupt habitat for wildlife to create more living space for people. People see one product of human architectural ingenuity—the glass-faced home or commercial building—as appealing and elegant, yet the glass can't be seen well by songbirds, and millions of hapless creatures collide with these structures, suffering and dying as a result.

Then there are some people's premeditated decisions to kill wildlife. In communities throughout the nation, people identify native wild animals as interlopers and declare them a "nuisance," conscripting "wildlife removal specialists" to remove the "problem." Removal typically translates into trapping or other types of lethal action. The Humane Society of the United States (HSUS) has strived for years to protect animals who live in our communities, and this lethal "nuisance" trapping is something The HSUS has always decried.

Since *Wild Neighbors* was first published in 1997, much has happened in the rapidly growing field of urban wildlife. Sadly, one of its true pioneers, Guy Hodge, passed away in 1999. Guy, who saw the beauty and importance of every creature, spent his entire professional life with The HSUS, working to ensure peaceful coexistence between humans and wild animals. Guy was a co-editor of the first edition of *Wild Neighbors* and the editor of its predecessor, *A Pocket Guide to the Humane Control of Wildlife in Cities and Towns* (1990). He was one of the very first people in animal protection to advocate for greater attention to what was termed the plight of urban wildlife.

Today, The HSUS promotes coexistence and offers practical solutions to concerned homeowners, developers, and transportation designers who wish to address conflicts with wildlife in a humane and sensitive way. The HSUS has amassed significant capacity to help wildlife in urban areas, especially in the wake of corporate combinations with The Fund for Animals and the Doris Day Animal League, both of which had their own substantive programs to protect urban wildlife. Our Cape Wildlife Center in Massachusetts and our Ramona Wildlife Center in California take in injured and orphaned wild animals to nurse and care for them until they can be set free. Our Urban Wildlife Field Office in Connecticut answers thousands of calls from the public every year, helping to resolve wildlife conflicts in homes or yards. Our Wildlife Land Trust focuses on the need for protection of the land crucial to the survival of wild animals, both endangered and abundant, on small tracts or large. Its goal is to protect properties in all fifty states. Our Urban Wildlife Sanctuary program celebrates the wild creatures who share our backyards. Through an award-winning newsletter, *Urban Wildlife News*, and an honorary certification program, we embrace the concept of sanctuary not only for homeowners' backyards, but also for schools, neighborhoods, even entire communities.

Wild animals are members of our communities. When conflicts arise, we can find ways to resolve them humanely. I urge you to join with The Humane Society of the United States in embracing this opportunity and helping us create a truly humane society. A humane society starts with you.

Wayne Pacelle
President & CEO
The Humane Society of the United States

Acknowledgments

The authors thank all of the individuals who made major chapter contributions:

Patricia Lane, Esq., of The HSUS and Michele Childs of the Vermont Legislative Council (for Wildlife Law).

Donald L. Burton, D.V.M., founder and director of the Ohio Wildlife Center in Columbus, Ohio (for Health Concerns).

Brad Gates, president of AAA Wildlife Control in Toronto, Canada, for information on humane wildlife control techniques (for Wildlife Conflict Resolution and Tools and Tactics).

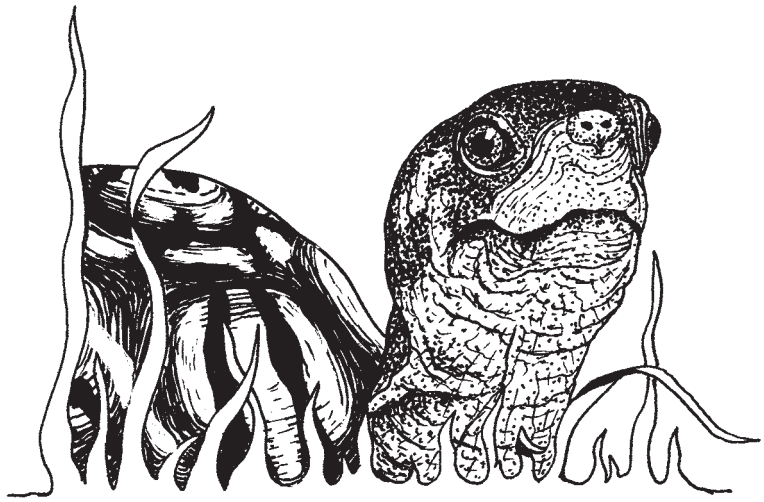
Russell Mason, Ph.D., administrator, Game Division, Nevada Department of Wildlife, Reno, Nevada, for repellents (Tools and Tactics).

Contributors, both in original content and review, to the chapters on individual species and providers of administrative support included Becca DeWeerdt, Richard Farinato, Marney Finkle, John W. Grandy, Ph.D., Susan Hagood, Pat McElroy, Andrew N. Rowan, Ph.D., Bette Stallman, Ph.D., Sydney Smith, Janet Snyder, Steve Swartz, and Bernard Unti, Ph.D., all of The HSUS.

We also thank Jean Bernard, Debra Firmani, John Griffin, Paula Jaworski, Deborah Salem, and Lori Thiele, who helped shepherd the project from manuscript to printed book.

Part 1

Living with Our Wild Neighbors



1



The Humane Approach

HUMAN BEINGS MAY NEVER HAVE a better chance to live in harmony with wildlife than they do now. For most of the time we have spent on the North American continent, we have used (and often abused) the wild animals who live among us. Today, we no longer depend on them for food or fur, and the notion that they exist solely to provide recreation and diversionary pleasures for our kind is discredited. Once-decimated populations are recovering and on the move into what common sense would argue are the least likely places to offer hospitality—our cities and towns. To wild animals, an opportunity is an opportunity, and if we grow plants they like to eat or offer shelter in uncapped chimneys, that is fine by them. We now meet them again, after so many years of estrangement and unfamiliarity, hoping that it is with the understanding and the will to harmonize our lives with theirs.

Once we viewed wildlife as a "resource" there for the taking; now we see wild animals as members of living communities to which we also belong. These communities work in complex ways to form ecosystems, about whose well-being we have become urgently concerned. In acknowledging that concern, we are encouraged to reject an anthropocentric perspective (the idea that humans are the center of the living world) and accept a biocentric one (embracing the idea that we are a part of, not apart from, other living things). In turn, this leads us to give ever greater moral consideration to the animals and the environments that sustain us all.

Still, our lives are not likely ever to be free of conflicts with wild animals. In fact, as our population grows and expands, conflicts are likely to continue to arise. This does not mean, however, that we must choose lethal solutions in seeking to resolve them. It is not right to kill problem-causing wildlife simply because it is within our power to do so.

This book is about humane solutions to conflicts between humans and wild animals. It advocates humane solutions as morally and ethically correct concepts, grounded in logical, durable, and environmentally responsible tenets. The approach we advocate rests on three organizing principles:

- Respect for the environment
- Tolerance and understanding of living things
- Intent to resolve conflicts using nonlethal means.

The term "environment" means different things to different people. To us at The Humane Society of the United States, it means a community of living things and the processes that sustain it. Respect for the environment tends to encourage us to intervene less often with natural processes and practice more often the art of patience in allowing natural laws to resolve conflicts. There are great powers in natural systems that human beings cannot control at all, and lesser ones that we can, but should not. The foundation of the humane approach is in working with natural processes rather than against them.

Tolerance and understanding are necessary prerequisites to fostering respect for the environment. Respect is essential to fostering the intent needed to commit to nonlethal conflict resolution. People are insatiably curious about the world, and this curiosity can be used in many positive ways. A small start would be to reject irrational fear of wild animals. No life should ever be taken out of ignorance and misunderstanding.

For many reasons human beings cannot currently resolve every human-wildlife conflict using nonlethal means. It is possible, however, to address each conflict intending to do so. We really have only just begun to investigate and understand the considerable arsenal of ideas, tools, and techniques at our disposal to resolve conflicts with wild animals without causing them, us, or the environment harm. Voices ranging from Walt Whitman's to Albert Einstein's have spoken with concern that human beings' technological capability seems to outstrip our ability to grasp the moral implications of its use. That is certainly true with respect to how easily, and how completely, we can use lethal methods against wild animals. The ease and expediency of lethal controls demand that a much greater effort be expended to advocate and adopt the nonlethal.

We have gathered the information in this book to help argue that point. Humane approaches to dealing with wildlife will not be created because we compose and publish books, brochures, or videos on the subject. They will only come about from the intent of a majority to adopt change. Some of the signs pointing toward this possibility are encouraging, others are not. It is our commitment to our wild neighbors to continue working to create a world in which we all can live in harmony.

2

Wildlife Conflict Resolution

Conflicts with wildlife can occur in many different contexts and at many different levels. A homeowner may find a squirrel has taken up residence in the attic or that deer are eating plants in her garden. A neighborhood may find it has a shared conflict with crows using a winter roost or geese camped out on the local ball field. This book is primarily concerned with encounters between homeowners and the wild animals who find their way into our yards, gardens, and houses, but in the context of the larger issues that engage us as a society in our interactions with wild animals. Whether a problem is small or large, there is logic to approaching it in steps that begin *before* action is taken as well as *after* action occurs.

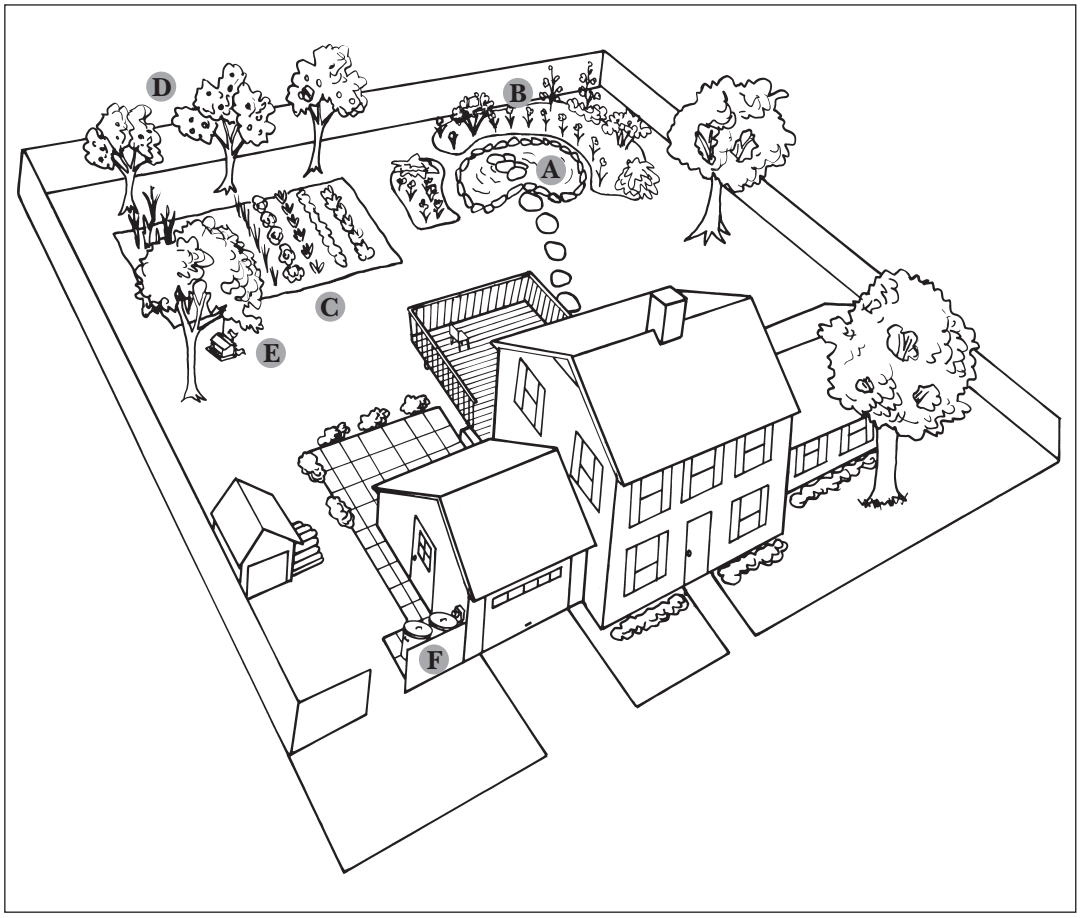
Common sense is really what wildlife problem solving is all about, but we can call upon concepts from the field of integrated pest management (IPM) to guide our thinking. IPM has evolved from a decision-making process that emphasizes the least harmful or environmentally damaging approaches to solving conflicts. It is focused primarily on insects and their control, a field in which the term "pest" is deemed more acceptable than when dealing with birds and mammals. If we change the term "pest" to "problem animal," the IPM approach becomes a sensible and reasonable strategy for all situations. The following steps illustrate an integrated problem animal management approach.

Define the Problem

The first step for anyone who experiences a conflict situation with a wild animal in or around his home is to ask: Do I really have a problem? Many times, the "problem" is really a misunderstood natural behavior. A fox walks through a yard one afternoon. A bat flies overhead at dusk. Does the animal have rabies? Will the animal attack me or my pets? Flocks of starlings are landing on my lawn. Are they damaging it? A little knowledge of such animals' benign behaviors can reassure an inexperienced homeowner that no threat exists.

Identify Damage

Suppose there *is* a problem and that it involves property damage or destruction. Where and when is the damage occurring? What species is causing it? How long has it been occurring? It is absolutely necessary to determine the species involved, the extent of damage, whether there are young animals present, and what environmental factors (such as available food or shelter) contribute to the intensity of a conflict with a particular species (Figure l). Damage assessment is critical in determining the action to be taken or whether any action is needed at all (Figure 2).



LORI BAKER

Figure 1 *The typical dwelling and yard can provide abundant resources for wild animals. Backyard ponds (A) attract many species of birds and mammals to drink or search for food, while flower (B) and vegetable (C) gardens and fruit trees (D) often tempt animals with promises of meals. More tempting may be spilled seed from bird feeders (E) or unsecured trash cans (F).*

Evaluate the Situation

How serious and/or extensive is the problem? Are there immediate safety or health risks to people or pets? Is the amount of damage insignificant? Real, but acceptable? Beyond acceptance? Likely to reoccur, or limited to a one-time occurrence? Noticeable damage often takes years to develop. Does discovery of damage necessitate trapping and relocating or killing animals? Even if an animal is causing some damage, is it enough to be classified as a problem or demand a solution? Timing is a key component of damage assessment: many problems with animals are of short duration or occur only during certain seasons.

Take Action

Only after the facts have been collected and evaluated should the need for action, the type of action necessary, and the timing of that action be considered. People often take direct action immediately after discovering a "problem," leading, tragically, to the suffering or unnecessary death of animals whose crimes did not merit punishment. Taking action to resolve conflicts with wildlife does not mean the action has to be lethal. Exclusion, repellents, changing human cultural practices, and habitat modification are all examples of nonlethal actions described in this book. If lethal action has occurred, as it often does because

people act before they stop to think, then nonlethal actions can still be crucial to prevent problems from reoccurring.

Assess the Action Taken

Has the action taken permanently resolved the problem? If not, how can the problem be prevented from reoccurring (Figure 3)? Frequently, whether or not action has been taken, the cause of the problem has remained untouched, making it necessary to deal with its symptoms time and time again. If lethal action has been taken, only evaluating the problem and taking steps to correct it can prevent reoccurrence (of both the lethal action and the problem itself).

These steps are not complex or difficult to understand or follow. With use they are no longer "steps" to remember but what they really are, a commonsense process. This common sense can lead to better resolution of human-wildlife conflicts, and it can prevent a great deal of suffering and unnecessary death.



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Figure 2 *Is it raccoon, squirrel, or deer damage, or damage by some other species? Identifying the species causing a problem is an essential first step in wildlife conflict resolution.*



THE HSUS

Figure 3 *Humane wildlife conflict resolution begins with prevention. This unsecured vent cover is an obvious invitation to a wild animal to explore the space under this building and, logically, finding it safe and dry, consider denning there. Inspection and repair are crucial before problems occur.*

3

Wildlife Law



SOME KNOWLEDGE OF THE LAW IS critical when seeking to resolve conflicts with wildlife, not only because homeowners need to protect themselves from inadvertent violations, but because good laws can help protect animals as well. Even many nonlethal solutions emphasized in this book may have legal implications. For example, under state law it might be illegal for a homeowner to live-trap and relocate a problem animal. Even putting up a fence to exclude wildlife from a yard may be prohibited by a local ordinance, neighborhood covenant, or homeowners' association rule.

We provide a brief overview of some of the laws in the United States concerning wildlife conflict resolution. The HSUS recommends that homeowners consult other sources, such as local wildlife rehabilitators or state wildlife agency personnel, for detailed information on statutes and regulations that may apply to wildlife. It is the homeowner's responsibility to know applicable federal, state, and local law; unintentional violations of the law are violations nonetheless. If wildlife is treated in a manner that may be unlawful, the appropriate state agency or local animal-control department should be contacted immediately.

Although navigating through the legal maze may seem to be a daunting task, the process can be made somewhat easier by breaking down the laws by jurisdiction. At the top rung of the ladder are federal laws and regulations; state laws and regulations form the next rung. Both federal and state laws cover broad areas, and each state usually has a law closely related to the federal one on the same topic. Under state laws are local laws and ordinances of counties and municipalities. Finally (but still very important for those who live in certain neighborhoods) there are homeowner association's rules, which can also play a big role in how members interact with wildlife.

A state law can never lessen the requirements in a federal law; it can only make them more stringent. This is an important point to remember, because even if you satisfy the requirements of a federal law, you still might be violating a related state law. The key to ensuring that you do not violate any law or regulation is knowledge.

Federal Law

Federal laws are codified in a publication called the *United States Code* (USC). If you see a reference to "USC" (e.g., 42 USC § 4332, which refers to part of the National Environmental Policy Act), you know you are dealing with federal law. Federal regulations are codified in a publication called the *Code of Federal Regulation* (CFR) (e.g., 40 CFR §§ 1500, *et seq* describes the regulations that implement the National Environmental Policy Act). Each state similarly codifies its laws and regulations in its own publications. These laws and regulations create requirements to be followed to ensure that a homeowner's actions are legal. We mention specific examples here of important federal laws that affect urban and subur-

ban dwellers. Be aware that others, such as those covering endangered species and wetlands, for example, may have important implications for how people interact with wildlife in or near cities.

The Migratory Bird Treaty Act (MBTA)

Perhaps the easiest law to violate inadvertently when dealing with human-wildlife conflicts is the Migratory Bird Treaty Act (MBTA). The MBTA makes it unlawful to pursue, hunt, take, capture, or kill migratory birds or to destroy any migratory bird nest or egg, unless such action is specifically permitted. For example, it is technically a violation of the MBTA to capture (or remove) a chimney swift, or her nest, from a chimney unless authorized by the U.S. Fish and Wildlife Service (USFWS).

The MBTA protects hundreds of native bird species that nest in or migrate through the United States. Some, such as woodpeckers, do not migrate at all, but still are afforded full protection. Only a very few bird species, particularly house sparrows, pigeons, and starlings, are not protected by the MBTA. These birds may be protected by state laws, however.

A property owner has no constitutional right to kill or harm federally protected migratory birds (or other wildlife) to protect property. Instead, a property owner seeking relief from bird damage must apply to the USFWS for a federal permit, even for such nonlethal methods as relocation. A commercial animal-control company is also required to have a federal permit. If a homeowner plans to seek assistance from a commercial operator, she should make certain the operator has any necessary state licenses and any required federal and state permits.

The Federal Insecticide, Fungicide, and Rodenticide Act

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) regulates pesticide safety and use. It not only regulates pesticides that kill wildlife (products that The HSUS does not recommend), but also regulates repellents and some other nonlethal methods. Both the Environmental Protection Agency (EPA) and state agencies regulate the use of pesticides, requiring them to be registered in accordance with FIFRA. Although a pesticide might be in compliance with FIFRA requirements, a state may limit or ban that pesticide outright. People who use the pesticides, poisons, and even repellents must do so in strict adherence to the instructions on the product label. The use of any registered pesticide in a manner inconsistent with its labeling violates federal—and possibly state—laws.

State and Local Law

Although federal and state laws protect most birds, endangered species, and other select groups (marine mammals are one good example), an individual state law typically protects other resident wild animal species.

Laws versus Regulations

Laws, also called statutes, are different in nature and form from regulations. The U.S. Congress or state legislatures pass broad laws that are applicable to the public at large. Laws very frequently state policy and general restrictions yet are not very specific in detail. That is where regulations come into play. Regulations implement laws by giving details and explaining how the laws apply to individuals. Government agencies, such as the U.S. Department of the Interior or a state's Department of Natural Resources, which are part of the executive branches of federal and state governments, establish and enforce regulations. Federal regulations are codified and published in the Federal Register *and state regulations in similar official state publications.*

State laws can be a mixed bag, as many originate from the special protection and favor accorded to "game" species, protected at some times of the year so that they can be killed legally at others. Wildlife law is evolving rapidly, if somewhat painfully, for those who wish to see greater protection.

State Animal-Control Laws

Often several different state agencies are responsible for overseeing different aspects of human-wildlife conflicts. State fish and wildlife, health, and agricultural departments are the ones most commonly involved. Because no two states regulate interactions with wildlife in the same way, a necessary first step is contacting the proper agency—before taking any action—as a precaution against inadvertent violations of the law. The agency whose name includes "wildlife" or "natural resources" is most often the best place to start.

In recent years some states have passed laws and issued regulations concerning species thought to carry diseases such as rabies. Generally, these laws and regulations prohibit homeowners and licensed animal-control agents alike from live-trapping and relocating certain animals identified as belonging to rabies vector species (RVS). Some states require that any live-trapped RVS be euthanized but may offer the option of releasing the animal on site—which is our preferred approach. Some allow an animal to be moved a certain distance, but no farther, before release, while others demand a trapped RVS to be kept under quarantine for a specified number of days before allowing relocation. Some states prohibit unlicensed live-trapping altogether. If it seems these rules are all over the map and rely more on personal opinion than scientific guidance, we agree. These laws and regulations may also change frequently, so it pays to check often.

States also differ in how, or even if, they regulate wildlife-control businesses. Some states do not regulate commercial wildlife-control operators at all, while others require that they be state-certified or licensed. Unfortunately, many states still do not require wildlife-control operators to have any training or even meet competency standards to obtain a license or practice wildlife control. *Therefore, it is always the homeowner's responsibility to ensure that the operator is knowledgeable and can offer a range of nonlethal, humane options for remedying the conflict*.

State Hunting and Trapping Laws

State hunting and trapping laws may also determine how and when certain animals can be controlled. For example, in some states beaver are classified as a game animal that may be trapped or hunted only with a valid license during the state's trapping and hunting seasons. At all other times, beaver and other furbearers, as well as game animals such as deer, may be protected and only be killed or removed under conditions set by the state wildlife agency. Because hunting and trapping laws vary from state to state, it is important to contact the state wildlife department to determine the legal status of a particular species before taking action.

States may classify other wildlife species as protected nongame species. In many states, for example, bats are now protected and may not be harmed except under specified conditions. Unprotected animals, such as Norway and roof rats, mice, gophers, and moles, sometimes referred to as "vermin" or "pests," can usually be killed, captured, or otherwise controlled without special authorization from the state wildlife department. But even though these species are unprotected, safe and humane methods are available and should be used when these animals cause problems for people.

State Anti-Cruelty Laws

State anti-cruelty statutes arguably give some protection to otherwise unprotected species, like rats and mice, depending on the statute. Generally, these laws make it unlawful to intentionally kill, mutilate, torment, torture, or cruelly beat any animal. All fifty states, and the District of Columbia, have anti-cruelty statutes. In most states, all animals, including wildlife, are protected; however, many

statutes exempt certain activities from the definition of cruelty. For example, hunting, trapping, accepted animal husbandry practices, the use of animals in laboratory research, and even "pest" control are specifically exempted under anti-cruelty statutes in some states or are legal because other laws authorize them. If a wild animal is killed in a manner that does not fall within the definition of legal hunting or trapping, the act may be prosecuted as cruelty. For example, killing a deer with a neck snare or a skunk with a bow and arrow may warrant a cruelty charge even if state wildlife laws are silent on the matter.

State wildlife laws are changing, and anti-cruelty statutes are starting to be applied to wildlife "control" methods that courts and legislatures have found to constitute cruelty. Some common and, we believe, especially cruel methods of killing captured wildlife include drowning and injecting industrial solvents into animals' bodies. While this area of law is still evolving, criminal prosecution of wild animal-control practices that involve cruelty are becoming more common.

Local and Municipal Laws

Local and municipal laws (often called ordinances) and neighborhood association rules (often called covenants or community restrictions) may further restrict the methods of animal control permitted in that location. For example, in many jurisdictions it is illegal to fire a gun in residential areas. Shooting troublesome raccoons in the backyard would not be legal in these locations regardless of state or federal law regulating interactions with animals. Some communities prohibit certain poisons and traps or strictly limit their use. Noise-making devices used to scare animals may be prohibited by local ordinance or a homeowner association covenant because they are just too noisy for neighbors to tolerate. Even putting up a fence may not be allowed in some locales or neighborhoods, or the types of fencing allowed may be limited or subject to review.

To ensure that you are complying with all applicable laws and regulations, you may need to consult your humane society, university extension service, game warden, or state wildlife department.

Resources

The classic and definitive work on wildlife law, now in its third edition, is Michael Bean and Melanie Rowland's *The Evolution of National Wildlife Law* (Praeger Publishers, 1997).

Federal laws are available for all topics and agencies at *www.gpoaccess.gov*. To find a specific state's wildlife agency, visit this U.S. Fish and Wildlife Service webpage: *www.fws.gov/offices/statelinks.html*.

The Center for Wildlife Law at the University of New Mexico Law School *(http://ipl.unm.edu/cwl/home.html)* is an important resource to consult for anyone interested in wildlife law, as is the Animal Legal Defense Fund (*http://www.aldf.org*).

A good example of animal-friendly community covenants and restrictions can be found at the website for Harmony, a planned community outside of Orlando, Florida: *http://www.weliveinharmonyfl.com/pdf/cahwc007.pdf.*

4

Health Concerns in Dealing with Wildlife

Wildlife diseases are becoming recognized more commonly as important issues when considering human health. West Nile Virus, monkey pox, severe acute respiratory syndrome (SARS), and raccoon rabies, for example, are newly recognized or reemerging wildlife diseases that potentially or actually affect humans in ways that cause concern. Many factors contribute to this trend, but one of the most notable is urban sprawl. As humans encroach on natural wildlife habitats, contact between wildlife and humans increases, which heightens the risk of exposure to diseases that can infect both wild animals and humans.

The ecological consequences of human-dominated landscapes have touched off a cascade of effects throughout natural communities. For example, the emergence of Lyme disease in suburban communities results in part from growing populations of host species where natural predators and competitors, more sensitive to landscape changes, may have been eliminated. High densities of white-footed mice, a key host for Lyme disease, increase the prevalence of the black-legged ticks, since the mice are a primary host for the larval and nymph (juvenile) life stages of this arthropod. Both nymph and adult ticks may potentially bite and spread Lyme disease to humans.

Animals and humans share more than 175 known communicable diseases. The term *zoonosis* identifies any disease transmitted from vertebrate animals to humans. Wild animals serve as reservoirs (the disease-causing agent lives and multiplies without damaging its host) for many zoonoses. Many diseases controlled by preventive health programs in domestic species (e.g., vaccinations for leptospirosis) go largely unchecked in wild animals.

Zoonotic diseases can be transmitted directly by contact with an animal or its blood, saliva, urine, or feces or indirectly by air, soil, and water contaminated with the infectious agent. Domestic animals may also be infected by contact with wildlife and subsequently expose human beings. Arthropod vectors, such as ticks and mosquitoes, also play an important role in transmitting diseases from wildlife to people.

Avoiding direct contact with wild animals is always advisable. When they must be handled, it should be by experienced and properly equipped individuals. For the average individual, indirect contact with wildlife disease agents or interactions with arthropod vectors (transmitters of pathogens) are likely to be much more frequent than actual direct exposure to infested animals. However, wildlife rehabilitators, researchers, veterinarians, and animal-control personnel are at increased risk of direct exposure to these diseases and should take additional precautions.

Most of our attention in this chapter focuses on awareness and prevention, the front line of defense against common wildlife-related diseases. Our intention is not to alarm or frighten but to cultivate an understanding of and respect for potential means of disease transmission and outline actions that can be

taken to avoid disease. With knowledge of zoonotic diseases, an individual can assist medical professionals in early diagnosis and treatment in the unlikely event of infection. Some uncommon but potentially life-threatening diseases are reviewed to emphasize the importance of preventing them. In any situation where a person or companion animal may have been exposed to a zoonotic disease, one should consult a private physician or veterinarian and public health officials.

Infection from Physical Injuries

When a wild animal is held against her will, she will use all available defenses to resist restraint. Without proper restraint techniques and equipment, the person restraining her is likely to be bitten, scratched, or otherwise injured.

If you are bitten or scratched, immediately clean the wound by scrubbing thoroughly with soap and water. Flush liberally with clean tap water if sterile solutions are unavailable. Proper early scrubbing and irrigation significantly reduces the chance that the wound will become infected. Wounds should be cleaned again with iodine or chlorhexidine-based solutions and irrigated liberally under medical supervision.

A physician or veterinarian should examine all wounds caused by a wild animal. Puncture wounds are often more serious than may appear at the skin surface and usually require antibiotic therapy. Discuss your tetanus immunization history with your health-care provider. The risk of infection from a penetrating animal bite ranges from 5 to 15 percent if expedient scrubbing and flushing take place.

The following section describes some of the major zoonotic diseases of concern for the species emphasized in this book.

Wildlife Diseases

Bubonic (Sylvatic) Plague (Yersinia pestis)

Hosts

Primarily rodents; especially commensal mice and rats. Wild rodents, including prairie dogs and ground squirrels, are also highly susceptible.

Background

Plague is rarely reported in the United States. When host numbers are great and are accompanied by dense flea populations, periodic outbreaks occur. Ninety percent of cases originate in New Mexico, Arizona, California, and Colorado. These outbreaks kill many rodents, which subsequently can increase the possibility of exposure for pets and humans as fleas look for alternate hosts. Bubonic plague is primarily a flea-transmitted disease but can be acquired through direct contact with infected animals and their tissues, or by inhalation. Feral and free-roaming domestic cats in endemic areas (places where the disease is prevalent) have been sources of infected fleas that transmitted plague to humans.

Clinical Disease and Symptoms

After a two- to six-day incubation period, the infection starts at the site of the flea bite. Characteristic symptoms include fever, headache, chills, muscle pain, weakness, fatigue, and upset stomach. In bubonic plague lymph nodes enlarge, forming “buboes” (hence the disease’s name), especially near the first exposure. The same bacterium also causes the rarer yet much more dangerous pneumonic plague, which may be transmitted through airborne infectious droplets.

Prevention

It is important to educate the public in plague areas about the nature of the disease and its transmission. Rodent population control, by exclusion and habitat management, should begin before populations reach high levels. People should be aware that rodent die-offs

might signal the start of a period of special concern. They should protect themselves and their pets, especially by controlling fleas. Finally, people at high risk and people who live in plague-endemic areas should consider immunization.

Chlamydiosis (Psittacosis, ornithosis, parrot fever) (Chlamydophila psittaci)

Hosts

More than 100 free-living bird species are potential reservoirs, especially pigeons and mallard ducks. This disease is most commonly spread to humans through pet birds and domestic poultry.

Background

Chlamydiosis exists worldwide and has long been described as a bird-to-human zoonosis. Though the majority of reported cases are associated with captive parrots and their relatives or poultry, direct contact with birds of any origin can increase risk for contracting the disease. The primary mode of transmission is infected excretions (feces). When dry, *Chlamydophila psittaci* bacteria become aerosolized (disperse as a suspension of fine particles from the air) and easily inhaled. Only a few infectious particles can cause infection in the respiratory tract.

Clinical Disease and Symptoms

The incubation period varies but generally is five to nineteen days. The less severe form of chlamydiosis can easily be discounted by sufferers as a mild respiratory virus. Headaches, fever, chills, and upper respiratory infections are found in 90 percent of cases.

Prevention

Education about potential exposure and mode of transmission is important, especially for those who frequently come into contact with or handle birds. Good personal hygiene, protective clothing, and mimimal exposure to exudates and feces from birds are important means of prevention. Quaternary ammonium compounds are recommended for disinfection. Spraying contaminated areas with quaternary ammonium compounds limits aerosolization of infectious particles and minimizes risk of infection.

Giardiasis (Giardia lamblia, aka G. intestinalis)

Hosts

Giardiasis is widespread, especially among aquatic species, often associated with raccoons, beaver, and waterfowl.

Background

Giardiasis is caused by a one-celled flagellated organism (protozoan, *G. lamblia*) and is the most common human parasite in the United States, estimated at 4.8 percent overall prevalence in the general human population. Children, due to their common lack of good personal hygiene, are approximately three times more likely to be infected than are adults. Some debate remains over the significance of *Giardia's* disease-causing abilities, even in the face of a number of reports implicating it as a cause of diarrhea.

Giardia of human origin can be transmitted to several wildlife species and vice versa. Infected humans, who pass millions of infective cysts per day, are the single most common reservoir. Humans become infected by accidental ingestion of the cysts through water or food contaminated with fecal material.

Direct handling of infected wildlife or exposure to feces-contaminated surfaces (such as cages) or water predisposes individuals to becoming infected with this parasite.

Clinical Disease and Symptoms

After a week-long incubation period, *Giardia* often remains a subclinical infection causing no noticeable symptoms. When noticeable, it is characterized by a variety of intestinal symptoms such as recurrent chronic diarrhea, flatulence, and abdominal discomfort. In the majority of cases, symptoms disappear in two to six weeks.

Prevention

It is essential to practice good personal hygiene, including frequent hand washing. Gloves should be used when handling potential reservoir species. Never consume untreated or unprocessed water, even if the source is assumed to be pure. Carry water on camping trips or process groundwater through approved filtering devices that will remove *Giardia* cysts. Boiling water for at least one minute or more is one way to ensure that untreated water is free from *Giardia*.

Hantaviruses

Sin Nombre (Spanish for no-name) *virus* (SNV), *Black Creek Canal virus*, *New York virus*, *Bayou virus*, and several other serologically distinct viral types in the New World

Hosts

In the New World, rodent species in the subfamily *Sigmodontinae*, including deer mice (*Peromyscus maniculatus*), cotton rats (*Sigmodon hispidus*), white-footed mice (*Peromyscus leucopus*), and rice rats (*Oryzomys palustris*), are known carriers of hantavirus pulmonary syndrome (HPS). In the Old World, hantaviruses manifest themselves in the form of hemorrhagic fever with renal syndrome (HFRS).

Background

In the 1980s hantaviruses were found in rodents in the United States but were not associated with human disease. However, the first outbreak of human disease was diagnosed in 1994 in the Four Corners area of the southwestern United States. Rodents maintain hantavirus as a persistent infection, shedding the virus in urine, feces, or saliva, and do not exhibit overt signs of illness. Humans become infected by inhaling small particle aerosols (dust) of virus-contaminated feces, urine, or saliva. Rodent bites may be another avenue of virus transmission.

Clinical Disease and Symptoms

After initial exposure, hantavirus incubates for two to four weeks before disease ensues. Previously healthy individuals suddenly develop symptoms of headache, fever, muscle pain, and dry cough. The first symptoms mimic a typical upper respiratory virus; however, these flu-like symptoms rapidly progress to acute pulmonary insufficiency (reduced blood flow to the lungs), indistinguishable from adult respiratory distress syndrome. Within days of onset, the patient can die from respiratory failure.

Prevention

The first step in disease prevention is educating communities about hantavirus transmission and prevention. The goal is to modify rodent habitat by preventing access to human dwellings and reducing rodent shelter and food sources. Controlling rodent populations near buildings by trapping or poison will only address the problem temporarily; habitat modification and exclusion must be the principal line of defense.

If someone must work in a rodent-infested place, protective clothing, including thick rubber gloves and appropriate respiratory protection, should be worn. Disinfect working surfaces or old areas of contact with a solution of household bleach (one part bleach to forty parts water) or with any Environmental Protection Agency (EPA)-approved, hospital-grade disinfectant used according to manufacturer's instructions.

Histoplasmosis (Histoplasma capsulatum)

Source

This fungus grows in soil and material covered in bird and bat droppings.

Background

Histoplasmosis cannot technically be considered a true zoonosis but must be designated as a saprozoonosis (environmentally acquired disease). Soil enriched with bird or bat droppings that encourage the fungus's growth is the primary reservoir, especially if the roost has been used at least three to five years.

Histoplasmosis has frequently been linked to roosting sites of birds and bats.

Winter assemblages of blackbirds, nesting gull colonies, pigeon roosts, and bat-roosting areas such as caves, mines, or bridges have all been point sources of environmental histoplasmosis. In all of these instances, the animals' excrement enriches the soil, promoting the growth of *Histoplasma capsulatum*. Birds display a remarkable resistance to infection but do transport the fungus. Bats can become ill and transport the fungus. Transmission is through inhalation of spores.

Clinical Disease and Symptoms

After inhalation of the spores, *H. capsulatum* usually causes disease that is not easily apparent. While infection is common in endemic areas, overt disease is not. In fact, in areas were this fungus is common, up to 80 percent of residents may test positive to a skin test. Children, the elderly, individuals with chronic lung disease, and people with compromised immune systems are most likely to exhibit severe clinical symptoms, which range from a mild hypersensitivity (such as an allergic reaction) to a disease-mimicking chronic pulmonary tuberculosis.

Prevention

The best line of defense in preventing exposure is to minimize potential contact by avoiding soil contaminated with either bird or bat droppings. If it is necessary to be in such areas, wear boots and use an appropriate mask or self-containing breathing apparatus.

Leptospirosis (Spirochete bacteria of the genus Leptospira)

Hosts

Skunks, raccoons, opossums, Norway rats, mice, and white-tailed deer are host species. Livestock and pets are also common carriers.

Background

Striped skunks, raccoons, and rodents are significant reservoirs for leptospirosis, with infection levels greater than 50 percent in some populations. In these species the bacteria commonly stay in the kidneys, where they cause slow, chronic pathologic changes and are shed for long periods of time. Transmission occurs by direct contamination of mucus membranes or broken skin by infected urine. Indirectly, leptospirosis can be acquired through contaminated soil and water. Leptospires can survive for three months in alkaline stagnant or slower-moving water.

Clinical Disease and Symptoms

The incubation period may range from two to twenty-nine days. Fever, headache, chills, weakness, vomiting, muscle pain, rash, and jaundice, or a combination of these, are noted early in the disease; in more severe infections, liver failure, kidney damage, blood disorders, meningitis, and respiratory distress may be present. Untreated severe cases can result in death.

Prevention

Avoid mucous membrane and skin exposure to the urine of wild animals while handling. Protect skin by wearing gloves, boots, and clothing that minimize contact with surfaces contaminated with urine. Use good personal hygiene following any potential exposure. Clean contaminated areas with common household disinfectant. Avoid swimming and recreational activities in bodies of water known to be contaminated. Vaccinate dogs for the prevalent type found in the wildlife of that geographic area.

Lyme Disease (Borrelia burgdorferi)

Hosts

In the United States, hosts are primarily white-footed mice (larvae, nymphal, and occasionally adult stages) and white-tailed deer (adult stage).

Vectors

Two species of Ixodid ticks are the primary vectors: *Ixodes scapularis* (formerly called *Ixodes damini*) in the eastern and midwestern United States and *I. pacificus* in California.

Background

Lyme disease is a spirochete bacterial disease transmitted by the bite of a nymph or adult

tick, causing debilitating illness in humans. The disease is carried by small animals, most notably white-footed mice (*Peromyscus spp.*). Larvae or nymphs become infected with the bacteria when they feed on these mice and store the bacteria in their gut for life. It is these infected nymphs and adults that may spread this disease to humans and their pets.

In the United States, the disease was recognized in Lyme, Connecticut, in 1975, but it had been recognized in the Old World since the early 1900s. Lyme disease gained national attention in the 1980s when the infectious agent was first isolated and named and doctors were required to report cases. Throughout the 1980s, more cases were reported each year. Now more than twenty thousand cases are diagnosed annually. Lyme disease has quickly gained the distinction of being the most common tick-borne disease in the United States. The majority of cases occur in the northeastern Atlantic seaboard states and the upper Midwest (Minnesota and Wisconsin). Cases have been reported less commonly but regularly in the remaining states. Most cases of Lyme disease are acquired in June and July when nymphal ticks' peak activity corresponds with increased human activity outdoors.

Clinical Disease and Symptoms

When a nymph or adult tick feeds on a human, it must be attached for at least twenty-four to twenty-eight hours before infection can occur. In 70–80 percent of cases, a characteristic bull's eye rash, the erythema migrans, develops in four to forty days. This rash clears in the middle as it expands up to twelve inches in diameter over several days.

Initial symptoms include fever, muscle pain, lethargy, headache, joint aches, and swollen lymph nodes. Even if left untreated, many of these symptoms may clear up on their own. In about 60 percent of untreated cases, arthritis, swelling, and pain of the large joints, especially the knee, occur within months of infection. Bouts of subtle nervous system disease such as memory loss, drowsiness, or numbness and tingling of the hands and feet may occur in about 5 percent of untreated cases. A small percentage of people may continue to exhibit symptoms months or years after infection, even after treatment with antibiotics.

Prevention

To avoid exposure to Lyme disease, eliminate contact with ticks. One way to do this is simply to avoid tick-infested areas, especially between May and July. When this cannot be done, wear light-colored, long-sleeved shirts and pants, tuck pant legs into socks, and conduct frequent tick inspections of clothing and body (every three to four hours). Be sure to check the hairline and inconspicuous and hard-to-reach areas with special care. Tick repellents used on clothing may also be effective. Remove attached ticks without crushing them and scrub the wound thoroughly. Tick and flea preventive medications on companion animals can minimize the risk of exposure to ticks that first attach to those animals.

Rabies (*in the genus* Lyssavirus *along with a number of bat viruses*)

Hosts

Any mammal can carry rabies, but the primary carriers in North America are raccoons, striped skunks, bats, foxes, and coyotes.

Background

Rabies is a rapidly progressive and commonly fatal viral disease that produces incurable encephalitis in humans and other mammals. With rare exception, it is transmitted by the bite of an infected mammal. The rabies virus has seven distinct strains that affect mammals other than bats, as well as a number of distinct variants, each associated with a particular bat species. This helps explain why different species are primary carriers of the disease in different geographic areas. Other less commonly infected species such as woodchucks usually become infected with rabies as a result of a "spillover" from the dominant carrier who often serve as "dead-end" hosts not transmitting the virus. Rodents in general tend to be dead-end hosts in that they typically succumb to this disease before having the opportunity to spread it.

Table 1 — Quick Reference to Human Health Concerns in Dealing with Wildlife

DISEASE	WILDLIFE HOST(S)	PRIMARY MODE OF TRANSMISSION	PREVENTION
BUBONIC PLAGUE	Prairie dogs, ground squirrels	Flea infestations, inhalation	Public education, rodent population control
CHLAMYDIOSIS	Birds (esp. pigeons, mallards)	Contact with feces, inhalation	Good hygiene, protective clothing
GIARDIASIS	Widespread, esp. aquatic	Ingestion	Good hygiene, especially hand washing
HANTAVIRUS	Rodents	Inhalation or bite	Public education, habitat modification/ exclusion
HISTOPLASMOSIS	Soil (esp. roosting areas) exposed to birds, bats	Inhalation	Avoid known roosting areas
LEPTOSPIROSIS	Numerous mammals	Ingestion, broken skin	Avoid handling and exposure to urine, practice good hygiene
LYME DISEASE	White-footed mouse, white-tailed deer	Tick vector	Avoid tick-infested areas, wear protective clothing
RABIES	Primary carriers: raccoons, skunks, bats, foxes, coyotes	Animal bite	Avoid contact; treatment regimen if bitten
RACCOON ROUNDWORM	Raccoons	Exposure to feces or contaminated soil	Avoid exposure to feces or likely infected areas
ROCKY MOUNTAIN SPOTTED FEVER	Rabbits, rodents, opossums	Tick vector	Avoid tick-infested areas, wear protective clothing
SALMONELLOSIS	Widespread: reptiles, birds, mammals	Ingestion	Hygiene, disinfection
TULAREMIA	Rabbits, rodents	Tick, biting fly, or contaminated water	Good hygiene, avoid contaminated areas
WEST NILE VIRUS	Primary reservoirs: birds	Mosquito or arthropod vector, accidental human-to-human	Control mosquito breeding, wear protective clothing

Since 1960 rabies in the United States has been reported more frequently in wild animals than in domestic species due to the success of vaccination programs. Wildlife now accounts for more than 90 percent of all reported rabies cases. Humans are considered exposed to rabies only when the virus is introduced by a bite wound to the skin or when the virus contaminates cuts in the skin or mucous membranes. Any penetration of the skin by teeth, even one that leaves little damage, is a bite exposure, and all are a potential risk for rabies, regardless of the bite severity or location. Bites of some species, especially bats, who have small teeth, may inflict only minor injury and may frequently go undetected. Nonbite exposures are much less frequent but may be a sufficient risk to consider post-exposure prophylaxis (PEP) treatment to prevent the disease. Casual contact with a wild animal, such as touching or even contact with feces, urine, or blood, typically does not merit PEP.

Though overall numbers are small, the possibility of humans becoming infected by bats, even when they are not aware they have been bitten, is a real concern for the Centers for Disease Control and Prevention. Its advice is that treatment should be considered in any situation when a bat is physically present and the individual cannot rule out a possible bite (e.g., when the individual was asleep and awoke to find a bat in the room or when individuals such as young children may not be able to report a bite reliably), unless prompt testing of the bat results in a negative rabies test.

Clinical Disease and Symptoms

Humans are relatively resistant to rabies. Only 15 percent of humans become infected with rabies after being bitten by a known rabid animal if they receive timely wound care. Incubation periods range from fewer than ten days to more than six years. After clinical signs appear, the virus is almost always fatal.

Responding to Exposure

As with any other potential zoonotic disease exposure, prompt consultation with a physician is extremely important. *Immediate medical response to a bite from any wild animal is critical*. Scrub any bite wound immediately and aggressively with soap and water. If available, use an antiseptic soap such as betadine or Nolvasan®. Flush or irrigate the wound thoroughly with water to remove organisms. A medical professional evaluating the wound and considering the offending species can determine the potential for rabies infection. It should be assumed that all bites from known rabies vector species could have transmitted rabies unless laboratory testing proves the animal to be negative for this disease. If the bite-inflicting animal can be captured safely, he should be held until animal-control agents can submit him to the local health department for rabies testing.

Prevention

People at risk for rabies exposure (veterinarians, animal technicians, field researchers, animal health laboratory workers, wildlife rehabilitators, or others who handle rabies vector species directly) should be protected by pre-exposure vaccination by one of three approved human rabies vaccines. Subsequent exposure to rabies after pre-exposure vaccination does not eliminate the post-exposure treatment but simplifies treatment by eliminating the need for human rabies immunoglobin (HRIG) administration and requires only two post-exposure vaccinations, as opposed to five.

In cases of potential or known human exposure, timely post-exposure prophylaxis (PEP) has been 100 percent effective in preventing human rabies in the United States. The treatment consists of HRIG infiltrations at the bite wound when possible, with the remaining volume being injected intramuscularly at a distance from the vaccination site. In addition, five vaccinations are given in the upper arm over one month.

Vaccinating companion animals such as dogs and cats is imperative. Even in areas without one of the dominant terrestrial carriers, the potential of exposure to bats always exists. Where rabies outbreaks are occurring or the disease is prevalent in animals such as skunks, local veterinarians may recommend vaccinating horses and other livestock.

Raccoon Roundworm (Cutaneous, Visceral, Ocular, and Neural Larval Migrans) (Baylisascaris procyonis)

Hosts

Raccoons (*Procyon lotor*) are the hosts, although closely related roundworms are found in other wild animals, such as skunks and bears.

Background

Larval migrans is a disease process started by ingesting the eggs of the raccoon roundworm, *Baylisascaris procyonis*. The larval parasite then begins prolonged migration through and persistence in internal organs and tissues. Different syndromes are named for the primary tissue invaded: cutaneous (skin), ocular (eyes), neural (brain, spinal cord), or visceral (organs) larval migrans.

Baylisascaris adults live in the small intestine of raccoons, rarely causing disease. The adult worms shed up to six million eggs per day in the feces. These become infective in three to four weeks under most environmental conditions. In the Midwest 44–85 percent of raccoons are infected. High population densities of raccoons, particularly in urban environments, the high incidence of *B. procyonis* among raccoons, and the persistence of eggs in the environment for months to years increase the potential for human exposure to eggs and, consequently, to infection. People in contact with raccoons and their feces have the highest risk of exposure.

Clinical Disease and Symptoms

The most common form of *Baylisascaris* in humans is minor tissue damage and encapsulation of the parasite in noncritical sites such as skeletal muscle. Large numbers of the parasite, however, can lead to more serious symptoms, including organ damage, loss of coordination, exhaustion, coma, blindness, and lung conditions similar to pneumonia. Central nervous system (CNS) disease is possible if *B. procyonis* invades the brain.

Prevention

The key to preventing exposure to raccoon roundworm is to avoid contact with feces or areas where feces have lain. The eggs are highly resistant to environmental and chemical disinfectants and can adhere to protected surfaces and remain in soil for long periods, even years. Old wood piles used by raccoons as latrines particularly should be recognized as sources of contamination and should be removed by individuals wearing protective clothing (coveralls and gloves) to handle logs and any other exposed material. Indoor cages where raccoons have been housed and areas contaminated by feces should be cleaned and disinfected with a household bleach solution (one part bleach to forty parts water). While it does not inactivate the eggs, bleach will help remove the sticky protein coat that makes eggs adhere to most surfaces so they can be removed mechanically by washing or flushing.

Rocky Mountain Spotted Fever (Rickettsia rickettsii)

Hosts

Hosts are primarily rabbits, rodents, and opossums, but nearly all mammals are potentials hosts for the tick vectors of this disease.

Vectors

American dog tick *(Dermacentor variabilis)* and Rocky Mountain wood tick *(D. andersoni)* are the vectors.

Background

Rocky Mountain spotted fever (RMSF) is not confined to western mountain states, as its name suggests, but is in fact reported more commonly in south-Atlantic states, where more than half of all incidents occur. South

Carolina and Oklahoma have the highest infection rates. Ironically, this disease is not very common in the Rocky Mountain region. The American dog tick (*Dermacentor variabilis*) in the east and the Rocky Mountain wood tick (*D. andersoni*) in the west are the primary regional vectors. In the United States, most transmission occurs between April and September. The actual infective agent of this disease is the bacterium *Rickettsia rickettsii*. The risk of contracting this disease from a tick is actually very low, with only 1–4 percent of all ticks serving as carriers, even in areas with high rates of human infection.

Clinical Disease and Symptoms

In human infection, a five- to ten-day incubation period is followed by nonspecific signs of disease such as lethargy and weakness that rapidly progress to fever, chills, headaches, and muscle and joint pain. Fever is the most predictable and persistent sign. The telltale petechial (spotted) rash occurs only in 45–60 percent of all cases, while 85–90 percent of all cases exhibit some sort of rash over the course of their infection.

Prevention

Measures to avoid tick contact are strongly recommended. One way to do this is simply to avoid tick-infested areas, especially between May and July. When that cannot be done, wear light-colored, long-sleeved shirts and pants, tuck pant legs into socks, and conduct frequent inspections of clothing and body (every three to four hours). Tick repellents used on clothing may also be effective. Remove attached ticks without crushing them and scrub the wound thoroughly. Topical flea and tick products or pet-safe insecticides on companion animals can minimize the risk of exposure to ticks that first attach to those animals.

Salmonellosis (Rod-shaped bacteria of the genus Salmonella*, including 2,400 serotypes. Half of all cases are from the Enteriditis [SE] and Typhimurium [ST] serotypes*)

Hosts

A number of species of reptiles, birds, and mammals are potential carriers of this bacterium.

Background

Salmonellosis is possibly the world's most common zoonotic disease. It is common in raw, processed meats, although proper cooking renders it inactive. Wild animals readily pick up *Salmonella* contamination from their immediate environment, especially from landfills, sewage treatment facilities, poultry processing plants, and livestock feedlots. Salmonellosis is also now recognized more commonly as an emerging disease of finches and other seed-eating birds who frequent backyard birdfeeders.

Clinical Disease and Symptoms

Salmonellosis is transmitted by accidental ingestion of *Salmonella*-contaminated feces, which includes indirect oral contact with contaminated surfaces. After a short incubation period of six to seventy-two hours, the disease commonly causes inflammation of the intestines with sudden onset of headache, abdominal pain, diarrhea, nausea, and vomiting. Symptoms usually last five to seven days. The signs can vary from barely discernible to very severe in young, old, and immunocompromised individuals. Resulting dehydration, especially in young children, can be life threatening.

Prevention

Good personal hygiene and proper environmental disinfection are important steps in preventing this disease. Currently, nonwildlife sources make up the majority of human exposures, but precautionary measures should be taken to minimize transmission when handling wildlife or coming in contact with feces.

Tularemia (Rabbit Fever) (the bacterium Francisella tularensis)

Hosts

Primarily lagomorphs (rabbits and hares; *Lepus spp*., *Sylvilagus spp*.) and rodents are the hosts.

Background

Ticks and biting flies are the primary arthropod vectors, but this disease can also be spread through inhaling airborne bacteria, consuming contaminated food or water, or handling infected animals. Inhalation transmission can include contact with airborne bacteria from the soil during such activities as lawn mowing or brush clearing, as was the case in one outbreak.

Clinical Disease and Symptoms

Symptoms of tularemia include skin ulcers, swollen and painful lymph glands, inflamed eyes, sore throat, mouth sores, diarrhea, or pneumonia. If the bacteria are inhaled, people exhibit flu–like symptoms. People with pneumonia can develop chest pain, difficulty breathing, bloody sputum, and respiratory failure. Tularemia can be fatal if not treated with appropriate antibiotics. In general the death rate in untreated cases is 5–7 percent. Infection with this bacterium results in similar symptoms in pets and livestock.

Prevention

In areas where tularemia is transmitted by ticks or insects, insecticides and repellents can help minimize bites. Anyone handling potentially infected animals, especially rabbits, should wear impervious gloves and practice good personal hygiene. Food should always be cooked thoroughly.

West Nile Virus (in the genus Flavivirus *of the Japanese Encephalitis Antigenic Group)*

Hosts

Hosts are primarily wild and domestic birds, the disease is incidental in mammals.

Vectors

Vectors are primarily mosquitoes in the genus *Culex*. In the United States, West Nile virus (WNV) has been linked only to mosquito transmission.

Background

WNV was first reported in the United States in August 1999 with the deaths of exotic birds at New York's Bronx Zoo. American crows and blue jays were also found dead in the area before any evidence of human infection. Before the 1999 U.S. epidemic subsided, sixty-two people were stricken with severe neurological disease, and seven died. From this small probable point of entry, WNV spread rapidly in epidemic proportions across the United States. WNV has now expanded into Canada, Mexico, and the Caribbean islands. This annually occurring disease is now well established in North America, with its prevalence depending on environmental conditions and human susceptibility. WNV and similar viruses of the genus *Flavavirus* occur in temperate and tropical areas of the Old and New Worlds. It is absent from far northern and southern areas—most of Canada, Alaska, Scandinavia, Greenland, and Antarctica.

Clinical Disease and Symptoms

Although recent human outbreaks of WNV have been associated with severe neuro-invasive disease, this does not tend to be the typical pattern. (In a recent outbreak, 80 percent of victims did not exhibit any clinical symptoms.) Those who do show symptoms typically exhibit the flu-like symptoms of headache, fever, and fatigue, sometimes accompanied by swollen lymph nodes, eye pain, and a rash. Several studies show approximately 1 person in 150 infected people have clinical signs of encephalitis and/or meningitis, the types of cases most frequently needing hospitalization.

Prevention

The most important means of controlling the spread of WNV is to limit or reduce mosquito

breeding habitats. Mosquitoes lay their eggs in stagnant water, and their larvae need this medium to survive. Therefore, it is critical to drain standing water from all outdoor containers such as buckets, flowerpots, and kiddie pools. Use screens on windows, porches, and outside aviaries. Many municipalities are using a combination of insecticides and integrated pest management to reduce mosquito populations.

While local governments work to control the spread of WNV, individuals can decrease their risk of acquiring the disease by limiting outdoor activity at dusk, wearing long-sleeved shirts and pants, using an insect repellent with 45 percent DEET® on exposed skin, applying permethrin (Permanone®) to clothing, and even using mosquito netting headgear in higher-risk situations.

Resources

Health Concerns

The information in this field is highly technical and the works cited below are not light reading. They are comprehensive and informative if you are seeking more information.

Acha, Pedro, and Boris Szyfres, *Zoonosis and Communicable Diseases Common to Man and Animals*, 3d Edition, Volumes 1–3 (Pan American Health Organization, 2001, 2003).

David Heyman, *Control of Communicable Diseases Manual* (American Public Health Association, 2004).

A number of excellent websites can be found on this subject as well, and on updates on emerging issues. A sampling of these includes:

Centers for Disease Control and Prevention. *http://www.cdc.gov/*.

General information: 800-311-3455.

For information about zoonoses that affect pets, check: *www.cdc.gov/healthypets*.

Morbidity and Mortality Weekly Reports. *http://www.cdc.gov/mmwr*

Emerging Infectious Diseases. *http://www.cdc.gov/ncidod/EID/index.htm*

Zoonosis References. *http://medicine.bu.edu/dshapiro/zooref.htm*.

We are indebted to Donald Burton, D.V.M., of The Ohio Wildlife Center for this summary and discussion of wildlife diseases. Dr. Burton has been in the forefront of investigation on wildlife diseases for many years, seeing and treating thousands of wild animals annually in his wildlife rehabilitation center. He believes that people should not be overly concerned or dramatic when confronting the issue of wildlife disease, but rather knowledgeable, cautious, and prepared. Prevention is the key here, much as it is with keeping wild animals out of houses and yards.

5

Finding Help

THE HOMEOWNER FACED WITH a wildlife problem often has no idea where to turn and, in seeking help, all too frequently can find herself following an endless trail of referrals. If she is looking for immediate assistance in resolving her problem humanely, there may be nowhere to turn. Animal-control and local humane agencies are often not able—or even permitted—to respond to nonemergency calls involving wildlife. State game and wildlife departments may not have staff who can respond either and may be located many miles away from where problems might be occurring.

If, on the other hand, the homeowner is merely seeking advice, she may feel overwhelmed by the number of sources and the disparity among suggested solutions to her problem. Local, state, and federal agencies all deal with different aspects of wildlife control, as do private wildlife-control companies, university cooperative extension services, wildlife rehabilitators, local nonprofits, and national organizations such as The HSUS. Friends, neighbors, and relatives are ready to offer advice or to pass on secondhand remedies they have heard about somewhere. All will differ, sometimes significantly, in the advice they give. To anyone who has experienced this, we offer our sympathies. In a more helpful vein, we also offer some general guidelines to follow.

Local Agencies

When a person has been bitten by a wild animal, or in other true emergencies, the local animal-control or police department is the first place to call. It can help gain access to immediate medical attention if needed and address any need to capture or control a wild animal. In nonemergency situations, the local animal shelter can also be a good source of advice—even if it cannot or does not respond itself. Referrals from these sources may lead to wildlife specialists, rehabilitators, or wildlife-control companies that can render assistance when needed. However, it is still the homeowner's responsibility to decide whose advice to take or whom to call upon for assistance.

State Agencies

The individual states are responsible for wildlife as a public asset and for enforcing laws and regulations, where these exist, concerning so-called nuisance wildlife. Contacting state agencies can be important if for no other reason than to determine what laws are applicable. Some states (and individuals) provide good advice and direction, others less so. State extension agents, usually working out of universities, may be a good source as well. (The extension services were originally created to assist agriculturalists and livestock producers and often still focus primarily on that mission.) State oversight for the use of pesticides used primarily to kill



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Figure 4 *It is the customer's responsibility to ensure that companies advertising their services as humane really are humane.*

rodents, moles, and some birds is typically vested in the agriculture agency.

Federal Agencies

The U.S. Fish and Wildlife Service (USFWS) is primarily responsible for the management of migratory birds and all federally endangered species. The U.S. Department of Agriculture's Animal and Plant Health Inspection Service (APHIS) has a Wildlife Services (WS) division that specializes in animal damage. Other federal agencies, such as the National Park Service, may become involved when parks or other lands they manage are being held responsible for wildlife problems in neighboring communities, Still, no federal agency focuses any special attention or effort on urban wildlife as a part of its mission.

Private Businesses

Increasingly, homeowners are using the services of private companies to resolve wildlife conflicts. These wildlife-control operators (WCOs) are not government officials and do not have the legal authority that animal-control officers (ACOs) often do. It is easy to be confused about this, and it is not made simpler by the variety of other terms (such as wildlife cooperator, pest controller, or problem-animal-control operator) sometimes used to describe those who provide wildlife removal services. These companies are usually listed under "Pest Control" in the Yellow Pages, along with the traditional exterminating services that deal with termites and rodents—a most unfortunate association.

When wildlife problems cannot be resolved by the homeowner using the self-help tactics described here, a WCO may be the only available resource. The most difficult part of wildlife problem solving may be deciding when it is necessary to seek such services. Wildlife control is a fledgling industry, in which services, levels of expertise, and devotion to professional standards vary widely. As of 2007, there were few restrictions against businesses advertising themselves as "humane" while engaging in practices that are nothing of the sort, so we urge caution in choosing these services.

Choosing a Wildlife-Control Company

How do you, the homeowner, tell, then, what kind of WCO you are dealing with? The initial call and on-site inspection and interview are crucial to deciding if the company you choose to employ is professional and reliable

and if it will use a humane approach. We recommend the following guidelines when seeking and contracting for services. (These are the suggestions of Brad Gates, president of AAA Wildlife Control in Toronto, Canada, a company whose business practices The HSUS feels should be used far more widely.) These guidelines cannot only help you determine whether a company will follow humane approaches, but they can also help to protect you as a customer from questionable business practices (Figure 4).

- Ensure that the company will provide an on-site inspection and a firm written quote; any fee for on-site inspection should apply to work contracted for if that becomes necessary.
- Ask for specific details about how the problem will be resolved and how the animal(s) will be treated. Will the animal be killed, and, if so, why? Might there be young who will be orphaned or abandoned? Be highly suspicious of any advice that animals will "have" to be killed.
- Ask if the company carries business liability insurance.
- Ask for assurance in writing that the company's practices are in compliance with federal, state, provincial, and local laws and regulations.
- Never sign a contract with an open-ended clause that allows a WCO to charge for removal of any wild animal who can be captured on you property. This may be presented as a sort of preemptive measure to prevent other problems that could be caused by "nontarget" species. This is an unethical practice.
- For animals in buildings, insist on the use of exclusion strategies involving one-way doors or hands-on removal and reunion of families leading to release on-site as the preferred means of conflict resolution.
- Make sure that the company provides a full range of animal-proofing/exclusion services, along with at least a one-year guarantee against animal reentry.
- Get a reference for the company from a local wildlife rehabilitator, humane society, or animal-control agency. Ask the organization how it has determined that the company uses humane practices.
- Ask for references from previous customers.

All of this should only take a few minutes of your time. As with any other service you might contract for, it is up to you to make sure you are getting what you pay for. It is no secret that some wildlife-control operators deliberately mislead customers into thinking that an animal will be "taken care of" by releasing her in a "better place," when in fact she will be killed, often by means that are far

Killing and Humaneness

Some people think that the humane approach we advocate means that wild animals never are, or never have to be, killed in wildlife-control work. Nothing could be more misleading. There is no way to know the actual number, but certainly tens of thousands of wild animals are killed annually because they cause conflicts. Many of these are animals' whose only crime was to try to use a house as a secure place to give birth and raise their young. People may blame the agents responsible because many of their practices are inappropriate, but the public that condones these practices, or does not even acknowledge that they occur, must bear the ultimate responsibility for capturing and killing these animals.

from humane. If you do not ask for and receive direct assurances that these steps will be followed, you will not be protecting your interests and ensuring the animals will receive humane treatment.

Humane Eviction and Removal Strategies

Probably the most common conflict suburban homeowners have with wild animals is the uninvited guest living in the attic or chimney or under the deck. The two most frequently used "solutions" when this occurs are either to capture and relocate the problem animal or to kill her. Resolving the conflict by using humane eviction strategies is by far the more ethical and biologically appropriate approach.

Eviction strategies can range from completely passive, where the homeowner waits until the animal leaves of her own accord, to more active harassment, which attempts to compel an early move. These strategies do not involve any direct contact with animals and, when approached with careful thought, can be pursued by any motivated homeowner. Direct removal practices that involve capture and handling of wild animals are best undertaken by individuals who are professionally trained and equipped. The ideal solution is to prevent problems from occurring in the first place, but by the time the homeowner finds out about an animal problem, it is often too late for that.

Beyond the need for professional assistance in capture and handling is a need for an understanding of animal behavior and ecology that the homeowner often lacks. Among the most important considerations in evicting animals from a structure is whether dependent young are present. It is one thing to drive a raccoon out of an attic in Boston in November and another entirely to do so in April. There is a high likelihood (but still not a certainty) that no young will be present in November, and exactly the opposite likelihood in April. If you live in Florida and face a raccoon problem, you may want to presume that young are present year-round!

A professional, responsible, effective, and humane approach to dealing with wild animals who have occupied human structures comes from Brad Gates in the form of a program we call the three Rs: Removal, Reunion, and Release. Remembering that this is something best done by a trained and experienced professional, we outline below the steps and logic behind this approach.



BRAD GATES

Figure 5 *These reunion boxes were developed by AAA Wildlife Control in Toronto, which uses them, as do a few progressive companies in the United States, to ensure that female raccoons and their litters are not separated when being evicted from houses.*

Removal. The obvious first step in dealing with an animal in a structure is to get her out. Removal strategies can be simple or quite complex, but they all avoid actual physical handling of animals wherever possible. If capture should become necessary, handling time is kept to an absolute minimum to reduce stress. During the birthing season, the homeowner should always assume that animals living in a house have dependent offspring, unless determined otherwise. It can be difficult to ascertain whether offspring are present without previous field experience and an awareness of animal behavior and biology. Experienced professionals use cues acquired from many previous jobs to locate and retrieve litters safely.

Reunion. Ideally, encouraging a mother to move her litter on her own terms, even if mild harassment is needed to accomplish it, is the best approach. When that cannot happen, mothers and litters can still be reunited by a trained professional using a specially built

"reunion box" that allows the young to be placed outside the entry hole but remain protected until the mother can retrieve them and move them to safety (Figure 5). Litters are often moved without any human pressure or involvement, for reasons we cannot be sure of. But it happens, and the objective in the approach described here is to mimic that process as closely as possible.

Release. The principal goal of humane removal strategies is not to remove the animal from her known home range (the area in which she has spent most of her life and therefore has an intimate knowledge of where to find food and shelter) (Figure 6). The goal is to get her out of the structure in which she has caused a problem and prevent her from returning. The strategy of "release on-site" allows mothers with litters to move them to another den while still being able to care for them as before. This can be nearly impossible if families are moved outside the mother's home range, where finding shelter, food, and water could present an insurmountable challenge. Even healthy adults without young may be compromised by being moved.

The strategy behind the three Rs is to make the process of human intervention as natural and humane as possible. Although companies such as AAA Wildlife Control have been using and perfecting the three Rs for more than twenty years, the strategy is still "new" to traditional wildlife-control companies that come from a recreational fur-taking background. Some landowners question the idea of accommodating problem wildlife within the boundaries of their properties, and others argue that this approach simply moves a problem elsewhere. Here are some of the most frequently asked questions regarding this strategy:

- *Won't the animal just move back into my house?*

No, not if the exclusion work is done correctly. Animals are opportunistic and will exploit structural weaknesses in buildings, and they do remember what worked for them in the past. To give an example, many raccoons in Toronto "know" that the base of a rooftop plumbing vent is only protected by a rubber membrane that, when torn open, gives them easy access to the attic. Once animal-proof screening is installed, the raccoon quickly learns that entry is no longer possible, although she might continue to test other houses for that weakness.

- *Won't the animal move into my neighbor's house?*

Perhaps, but only if a preexisting structural weakness exists, or if she has found refuge there before. Animals such as squirrels and raccoons have an intimate knowledge of the area in which they live (their home ranges) and know and remember useful foraging and denning sites. When pressured—as when evicted from a house, and especially when burdened with the care of young—they will go to a site they already know and have used before.

- *What happens if the young are not retrieved?*

If the eviction is done carefully and by someone with experience and the right equipment, only a small number of cases will result in the young being abandoned. In those few cases, local wildlife rehabilitators will usually accept these babies, knowing that a reputable wildlife-control company made sincere efforts to avoid this situation.



THE HSUS

Figure 6 *Live-trapping and relocation of "nuisance" wildlife is still commonly practiced, but it is increasingly recognized as ill-advised in all but special situations. It is far better to resolve conflicts without going to such extreme measures. New approaches make more humane options both practical and possible.*

• *Can I do this myself?*
The three Rs is really not a do-it-yourself activity. Often, it involves direct capture and handling of adult animals, an undertaking we strongly discourage the average homeowner from attempting.

• *Can I do the repairs?*
Perhaps, depending on how skilled you are in that department. But we should note that the material and construction work to prevent the animal from reentering is often not a simple repair-to-original specification. Because animals have gained entry before, it may be necessary to adapt repair work. Often this means a strategy based on years of experience with different species and understanding what works best on each one. It may be difficult to find a professional who meets the standard for the humane approach as outlined here, but we encourage you to try to adhere to these principles. This approach should be the standard approach in urban wildlife control—not the exception.

Wildlife Rehabilitators

People who care for sick, injured, or orphaned wildlife are called wildlife rehabilitators. The goal of wildlife rehabilitation is to care for an orphaned or injured animal with the objective of returning the animal to the wild. A conscientious rehabilitator will want to release an animal who is completely wild, not one who is tame. In growing numbers, rehabilitators are becoming a valuable (and valued) resource in dealing with wildlife problems. Having once been almost exclusively a preoccupation of individuals who literally opened their homes to cage nesting birds, baby rabbits, and other temporary boarders, rehabilitators now are usually licensed by their state wildlife agencies, have separate caging and housing areas to care for animals, and in increasing numbers work out of professionally equipped and staffed centers that may handle thousands of animals annually.

Unfortunately, not every locality has a rehabilitator within a convenient distance. State wildlife agencies keep lists of licensed rehabilitators and can tell you which ones serve your area and what species they accept. Other sources of information are listed in appendix A. Rehabilitators can also provide guidance in finding humane animal-control services and companies in your local area. Because most rehabilitators are swamped with injured and orphaned animals during spring and summer months, they sometimes have to refuse to accept even perfectly healthy animals.

Homeowners with wildlife conflicts can do their part to prevent orphaning or injuring wildlife unnecessarily by consulting rehabilitators, delaying action if possible, and working toward a solution that does not necessitate handling the animal. One critical service most rehabilitators can provide is to advise people who think that a young animal they see has been orphaned. Well-intentioned and caring individuals often "rescue" fledgling birds, baby rabbits, or deer fawns who seem to have been abandoned by a neglectful parent, when in fact this is not the case. Because rehabilitators have experience with young animals and are motivated to avoid taking on otherwise healthy and cared-for young, they can be immensely helpful in such situations.

Wildlife Hotlines

Some local communities, usually though the volunteer services of wildlife rehabilitators, have access to telephone advice hotlines for people with wildlife problems. These services can be critical in providing immediate advice and referrals in situations involving orphaned and injured wildlife and in true emergencies as well. They can also provide information on how to resolve wildlife conflicts humanely.

6

Questionable Practices and Inappropriate Products

THE HSUS BELIEVES IT IS IMPORtant to draw attention to certain urban wildlife-control products and practices that we judge to be inappropriate and inhumane. It is not always easy, of course, to determine what is humane and what is not, and it can be very difficult to decide what is and what is not "necessary" (as opposed to convenient) in wildlife control. Sometimes the case against killing animals seems more difficult to argue, as when birds are killed at airports because of the potential hazard they might pose to the lives of people on aircraft. Often it is easy, as when we oppose a trap set to kill a squirrel for having done nothing more than think an attic might make a safe home.

Many situations can be cited in which animals may suffer or die as a result of human decisions and actions that, on critical examination, seem deeply flawed. Sometimes they go even beyond flaw into forms of tragic irony. For example, on at least one national wildlife refuge, "resident" Canada geese have been rounded up and killed in June so they do not eat the crops being raised for the migrant Canada geese who arrive there in the fall.

As the argument over whether killing is right or wrong rages, we at The HSUS acknowledge the fact that killing is happening and will continue to occur into the foreseeable future. Where it cannot be stopped, we must strive to minimize the use of what we call *least* humane techniques. Consider mouse problems, probably the most common human-wildlife conflict in North America. We argue that the best way to deal with rodent problems is to prevent them in the first place. But what if mice are already in a building? Mice can be trapped and relocated with some (albeit small) confidence they will survive a move, but we believe most will not. Only a very small minority of people will be willing to take the time and effort to live-trap any mouse humanely before they resort to some means of lethal control. This mandates that we discuss the available killing techniques with an eye toward raising public awareness, not about those that are the *most humane*, but rather the *least inhumane*. The practices and products described below are ones we feel should always be questioned and, in many cases, opposed outright as inappropriate to our interaction with wild animals. Some are not available to homeowners but may be used by licensed commercial or government agents in local programs. These can affect you as a customer or community member, and we feel it is important that you know about them.

Moving Nuisance Wildlife

Too often people think the most humane way to solve a problem with the raccoon or squirrel that moves into the attic is to capture her in a cage trap and take her to the "country," which often means a nearby park. There, the reasoning goes, she will be released into a more "natural" habitat, and the problem will

be solved. Too late, such people might realize that she was nursing a litter, which is now orphaned, and that this relocation (more commonly termed a translocation) was not a safe, benign, or humane procedure.

Wildlife professionals debate translocation, and most acknowledge that answers to many of the issues involved must await additional studies. It is clear that translocation sometimes works very well and at other times does not work at all. Trapping and moving the animal may harm or even kill her or her dependent young. It may also adversely affect the resident wild animals at the release site.

Often, state wildlife agencies restrict which species can be translocated and how far they can be moved. For this reason it is important that you be informed about what is and is not legal in your area. Common sense would argue that there are circumstances under which it would be cruel to translocate any animal, legal or not. Moving a gray squirrel in February, for example, would certainly be a death sentence in most northern states, and perhaps elsewhere as well. The majority of conflicts between people and wild animals can be resolved by the simpler, more humane means described in this book. Our advice is that translocation be considered only as the next-to-last option in solving a wildlife conflict (killing being the last). If you must consider translocation, we recommend seeking the advice of a wildlife rehabilitator on release strategy, since much of what he tries to do is successfully release wild animals who have been in his care. No one should translocate animals without making every effort to deal with the root cause of the conflict and ensuring that it will not reoccur.

We feel it appropriate to address the issue of live, or cage, trapping here as well, since the popular and readily available metal box or cage trap is used to capture wild animals for relocation. Cage traps, available in a wide variety of styles and designs, are usually sold in most large hardware and garden stores. Cage traps are also often available on loan from local animal-control agencies or humane societies. Once widely advocated as the best tool for "solving" wild animal problems, these devices are receiving more scrutiny. We have also seen too many instances in which poorly monitored or improperly designed traps resulted in animal deaths. For example, solid-sided metal traps are still marketed and sold for use with skunks, presumably because the chance of getting sprayed by the skunk is much smaller in a trap where the skunk cannot see and be threatened by an approaching person. Under even moderate extremes of heat and cold, these traps can become death chambers, causing horrific suffering. If a solid-sided trap must be used in a particular situation, it should be made of plastic, which does not compromise the trapped animal thermally as rapidly as does metal.

Live-trapping any wild animal is a risky business for animal and human both. We urge restraint and caution in any such attempt.

Wildlife as Pets

Wild animals should not be kept as pets. We say that knowing full well how popular some wild species are as pets, and that even our beloved cats and dogs were once wild. Untold generations of selective breeding, however, made the animals who share our homes as we know them today. Their wild relatives, such as wolves or bobcats, retain an independence and self-reliance that has never been altered by selective breeding.

Wild animals can be difficult or impossible to care for humanely; many are dangerous and unpredictable. They may appear tame, docile, and manageable as they grow up, but as they mature, and especially as they become sexually active, their docility typically ends. Ultimately, the animal becomes a problem to the owner. She is neglected, passed from owner to owner, or released—often illegally—either into unsuitable habitat harmful to her or so vulnerable that she may cause damage herself.

The practical reality of this fact is the tragedy of the pet trade in wild animals. No one has a good handle on the overall dollar value of this trade or the numbers of animals involved, but the industry includes both native and exotic species in significant num-

bers. In the United States, nine million native and exotic reptiles were kept as household pets in 2000. In a single year, imports of iguanas to the United States from Central and South America have ranged from 600,000 to 800,000. Contrary to the assertions of pet dealers, commercial breeders, and hobbyists, the trade in wildlife can and does adversely affect conservation efforts to help animals in the wild.

There is no simple solution to the problem of wild animals as pets, but public awareness campaigns are important, as are the growing number of local and state regulations that prohibit private ownership at least of obviously dangerous animals.

Rodent Poisons

Perhaps the most frequently used lethal products in all of wildlife control are the poisons we refer to as "rodenticides." Rats and mice in many places have now become immune to the first generation of these products, developed largely in the 1940s. More powerful compounds are coming into use, to which we expect rodents to develop increasing levels of immunity as well. Most of the current generation of rodenticides are anticoagulants that depend on repeated ingestion over time to build up fatal dosages. These poisons take advantage of the fact that rats are samplers—when they encounter new food, they eat a little bit at a time to see if it is palatable. This habit increases the poison's efficiency because the rat does not associate ingestion with pain or discomfort.

The slow deaths suffered by any animals who ingest these poisons (which may include pets, wild predators or scavengers and, rarely, even humans) raise such overwhelming concerns about pain, suffering, and safety that their use must be challenged. Vast quantities of rodenticides are used routinely by homeowners who may be careless or unaware of the consequences of using these dangerous chemicals. Rodenticides are used far too widely in our society today.

Bird Poisons

Avitrol® (4-aminopyridine), a chemical used to control bird problems, is registered for use as a "flock repellent," even though its action has lethal consequences. The label stipulates that the product be applied to only a small proportion of a bait that is set out for problem birds (typically pigeons, starlings, and house sparrows). Birds who ingest treated bait will experience acute distress and engage in behaviors (vocalizations, fluttering of wings, staggering, and struggling) that alarm other members of the flock, producing responses said to lead to flock dispersal. Any bird ingesting the chemical can consume a lethal dose. Thus, all birds who consume treated bait will be at risk, and unless extremely careful bait placement and monitoring occurs, nontarget birds can also be exposed to the chemical and die. The HSUS does not support use of this product under any conditions or circumstances.

Another bird poison, DRC-1339 (3-chloro-4-methylbenzenamine hydrochloride), is often referred to by the popular name "starlicide," as it is frequently used for killing starlings. Its use extends to other birds, including gulls, pigeons, magpies, crows, and ravens. It is a very dangerous toxicant whose application is restricted to certified personnel, usually agents of USDA Wildlife Services. Once more common in agricultural settings, DRC-1339 is now used more frequently in urban bird "control," such as for poisoning crows on winter roosts. Large birds, such as crows and gulls, may take several days to die after being poisoned. We believe that such deaths are expressly inhumane, but advocates of the poison do not. The HSUS opposes the use of this product in any form of animal control.

Gas Cartridges and Concussion

Several toxic gases, including sodium nitrate, sulfur, carbon monoxide, and red phosphorus, are packaged into cartridges that are

ignited or discharged in burrows in attempts to kill animals taking refuge there. Similarly, a device that combines oxygen and propane inside burrows is intended to kill the animals inside by explosive concussion. Aside from dangers to people from accidents or careless handling, the discharge from these devices indiscriminately kills, maims, or otherwise injures *any* animal in the burrows, whether targeted or not. Few, if any, studies have been conducted to establish the efficiency of these cartridges and exploders, such as the length of time until death, the rate of "sublethal dosing" (referring to animals that are subjected to and affected by toxic fumes but are not killed immediately), and injuries to animals trapped in burrows. We suspect there is a high incidence of extreme suffering and slow death in animals from these products and do not support them under any conditions or circumstances.

Body-Gripping Traps and Snares

Body-gripping traps cover any number of devices, including "leghold" traps, snares, and the body-crushing "conibear" traps (actually a brand name, but conibear is also a common name used to describe this general type of trap). Body-crushing traps theoretically are supposed to cause rapid death by breaking the spine of the captured animal, but even under ideal test conditions, they often do not. Leghold traps are intended to capture and hold the animal until he can be retrieved or dispatched, as are locking snares—wire loops which, when stepped through, tighten around an animal's leg or neck. Other snares without locking devices simply tighten further as an animal struggles, causing massive injury or death. All of these devices can, and frequently do, cause intense suffering, pain, and injury. The HSUS and an ever increasing number of state and municipal governments and organizations have opposed the use of such traps for any purpose, leading, we feel appropriately, to an increasing number of outright bans as an educated public demands they be prohibited.

Acetone and Other Solvents

Some misguided entrepreneurs engaged in the business of wildlife control have experimented with the use of industrial solvents, such as acetone or denatured alcohol, as a means of killing wild animals. The typical procedure is to use a pole syringe, which allows the user to inject an animal in a cage trap from a distance, delivering the chemical directly into an animal's lungs. Its action there is undocumented but certainly involves massive tissue destruction. Skunks, in particular, are often targeted for this procedure, since they die what is described as a "quiet" death and often do not spray as they succumb to the effects of the solvent. Whatever the appearance, there have been no studies on this practice to measure the suffering animals might experience. The HSUS considers this and any other practice that is used to kill wild animals, but has not been subjected to rigorous scientific study, to be inappropriate.

Thoracic Compression and Bludgeoning

Among the many disputed techniques that come from traditional trapping practices are thoracic compression, in which one stands on a trapped animal's chest until the organs are crushed and the animal dies, and bludgeoning, where the animal is hit repeatedly on the head until dead. Some also use thoracic compression to dispatch small birds, by holding them in the hand and pressing on their chests with a thumb until they expire. We condemn these techniques, whether they are used by a recreational trapper or a professional wildlife biologist. We believe there are far more humane and acceptable ways of bringing death to wild animals.

Drowning

Recent scientific evidence suggests rather conclusively that drowning is an inhumane method of killing animals, wild or domesti-

cated. Although commonly used by wildlife-control operators and long a standard practice for recreational and commercial fur takers, drowning is condemned by The HSUS as an inappropriate and inhumane method for killing any animal.

Glue Boards

These devices are simple cardboard squares coated with extremely sticky glues used to trap small mammals, then slowly kill them through a combination of stress, exhaustion, and eventual dehydration or suffocation. Nontarget animals encountering the traps and small enough to become mired in the glue will face the same fate. Glue boards are easy to use and inexpensive but probably cause more suffering than any other product used in wildlife control. One specially made form of glue board is advertised to capture snakes, with the recommendation that vegetable oil can be used to free the trapped victims if the user does not want them harmed. We seriously question this counsel, particularly given the variable success rates and extreme difficulty encountered by those who have tried to free animals from these sorts of traps. Glue boards are inappropriate for solving wildlife problems and inhumane under any circumstances or conditions of use.

Polybutenes

Polybutenes are highly dense, sticky substances (such as the commercial products Tanglefoot® and Eaton's® 4 The Squirrel™) that are marketed in different formulations to discourage birds and squirrels from climbing, sitting, or roosting on treated surfaces. Manufacturers claim the substances only discourage animals by making them uncomfortable on the treated surface. However, as with glue traps, animals exposed to these materials have been treated in wildlife rehabilitation clinics, and deaths have been reported, notably in smaller species of birds. We recommend they not be used.

Predator Urine

One product that is appearing more and more frequently in garden supply and hardware stores is "predator urine," which may be variously billed as "safe," "organic," and "humane." Allegedly the by-product of coyotes, foxes, bobcats, and other animals, these products may be safe and organic, but they are likely not humane. Judging by the volumes sold, predator urines can only be generated by confining hundreds, perhaps thousands, of wild animals. If that is the case, we know of only one likely source: "fur farms," which are facilities that raise wild animals for their pelts. These are often little more than a series of small wire cages in an open shed, and animals at these "farms" suffer extreme confinement and poor housing conditions and typically die inhumane deaths. Neck breaking, gassing, and anal electrocution are common killing techniques. Thus, in addition to the abject suffering and cruel treatment that they must endure, fur-farmed animals are also wrung dry for the small profits their urine may bring from unwitting gardeners, trying to do right by using "natural" products. We urge these products not be used and hope consumers will make their concerns known directly to any business enterprise that has them on the shelf.

Resources

Euthanasia

The American Veterinary Medical Association periodically publishes a report on euthanasia that contains guidance from a panel of experts about their best currently available recommendations. We agree with some parts of this and take exception to others, but it is the best published standard available at this time. *www.avma.org/resources/euthanasia.pdf*.

7

Living in Harmony

We sometimes don't think about the unintended or indirect impact we have on wild animals, but human beings are responsible for many threats to animals' survival beyond deliberate acts that harm them or cause injury. Today road mortality may be the most significant, or the loss of habitat from development, or the ever-growing number of buildings with reflective glass. Here we discuss a number of the threats we create for wild animals, most often unintentionally, but no less harmfully.

Wildlife Feeding

Wild animals should not be fed when the consequence of feeding could cause them harm. The possible impact on wild animals' welfare from human feeding is truly complex and challenging. People's actions, individually and collectively, reflect this complexity and are often contradictory. On the one hand, we support a multimillion-dollar industry devoted to feeding wild birds. On the other we pass local ordinances that prohibit feeding pigeons, ducks, and geese where they have been declared public nuisances. Sunflower growers in the Midwest, with assistance from federal agencies, kill thousands of blackbirds every year because they eat crops that will be harvested, processed, packaged, and sold—to feed backyard birds.

People feed wild animals for many reasons; to be kind, to see them close up, to have a personal relationship with particular animals, or to make amends for human preemption of animals' habitat. When people feed some animals, especially those who may be viewed as nuisances or, worse, dangerous by other people, the consequences can be tragic. When an animal fed by one family loses his wariness of human beings and looks for a meal at the house down the street, he may receive an entirely different, and sometimes ultimately fatal, reception.

What species to feed, what and how much food to offer, and when to feed are all part of a complex calculus that must balance the potential for harm or good (Figure 7). Moderation is always a good idea, whether we are feeding wildlife or ourselves. Winter feeding of birds is widely justified as an educational, humane, and recreational experi-



PHAEDRA WILKINSON PHOTOGRAPHY

Figure 7 *Feeding a wild animal can be a formative experience for a child. Excessive feeding that creates dependency can lead to conflicts with tragic conclusions for animals, however, and it is imperative that we not feed wildlife whenever the consequences could lead to harm.*

ence with animals who do not cause conflicts with people. But the person who goes on a three-week vacation in the depth of the winter and leaves empty feeders behind probably should have thought about the consequences before starting to feed that year. Long-term good is never likely to come from feeding animals who have the potential to cause conflicts, such as bears or even raccoons, but is much more likely to come from moderate feeding of others that rarely cause conflicts, such as songbirds.

Birds and Windows

Many people would be surprised that office buildings—and even their own homes—can be death traps for some wild animals. Human beings unwittingly kill millions of birds each year. Birds can fly into any variety of structures—TV towers, wires, wind-generating turbines—and be killed, but most die as a result of collisions with windows. By day window glass can reflect a scene that looks to a bird as if it were a perfectly unobstructed flyway; mirrored windows especially present this threat. By night lighted structures disorient them and draw them into fatal collisions, especially under certain weather conditions. Others, caught in the light "traps" created by buildings and outside lighting, will circle until exhausted and descend to ground, where predators or traffic may take them. At least a quarter of all bird species in the United States and Canada have been documented as striking windows, and upward of 900 million individual birds may be killed annually.

As frustrating as this situation is, the individual homeowner can take some simple steps to help reduce strikes. Window decals, available at most wild bird stores, have to be applied every few inches to a window to make a flyable path appear solid. Newer versions of decals are nearly invisible to humans, but birds can see them in the ultraviolet spectra that we do not perceive. Plastic mesh or a special screen can be placed in front of problem windows to act as a cushion for colliding birds. Feeding birds can contribute to window collisions: birds using a feeder can be startled into flight, then bolt into the air with enough momentum to strike a window lethally. Placing the feeder either directly next to the window or at a distance of more than thirty feet is recommended, with all feeders located near what is called "escape cover," an evergreen tree or shrub that birds can flee into when panicked.

Programs in several major cities seek to address the issue of bird-window collisions via simple power-down protocols. These programs involve convincing building managers to reduce interior lighting at certain times of the year and under certain weather conditions. In the long run, though, we hope for technology that imbeds ultraviolet, light-reflecting particles within glass so the glass appears solid without obscuring the view—of the wildlife.

Wildlife and Roads

Imagine hiring a contractor to build your new house. Due to an unfortunate miscommunication, he builds your kitchen on one side of a busy street and your bedroom on the other. Once the house is finished, it is otherwise lovely, so you decide to move in anyway. It isn't long before you realize, though, that you risk your life just going from your bedroom to the kitchen and back again. This is exactly the situation wild animals regularly face. With nearly four million miles of public roads in the United States and uncounted miles of private roads, wildlife habitat is broken into pieces. Millions of animals are killed on roads every year, as is obvious to anyone who drives anywhere with any frequency. It is tragic that the closest and most continuous association that most members of the public have with wildlife is the sight of dead animals in the road.

What can be done to stop this destruction? The first and best line of defense is an informed public and educated, alert drivers. We offer these suggestions to anyone who drives:

- Expect to see wildlife in the road at dawn, dusk, and in the first few hours after darkness falls. Some animals, such



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Figure 8
Most collisions could be avoided if motorists slowed down. More cars and more wildlife on the road are a growing concern, but reducing speed, increasing vigilance, and the development of warning technologies all hold promise of decreasing the number of collisions.

as deer, are more likely to be moving and crossing roads in certain seasons, such as fall, when they are mating. Be especially aware then (Figure 8).

- Drive with extra caution on roads bordered by woods or agricultural fields, where roads cross streams, and especially where posted signs warn of crossing animals.
- Lower your dashboard lights slightly, as this will enable you to better see the reflection of your headlights in the eyes of animals.
- Where there is one animal, there are often more. Assume they will not know to get out of your way.
- Most important, slow down! Most collisions could be prevented if drivers were not going too fast to avoid hitting an animal.

Despite taking these precautions, a collision may leave an animal alive and in need of help. By carrying a few simple items in your trunk (a towel, blanket, heavy gloves, cardboard box), you may be able to retrieve and confine the animal safely and get him to a veterinarian or wildlife rehabilitator.

- Do not put your own or other people's safety at risk. Unless you can move the animal from the road in absolute safety, do not attempt to do so. Use your hazard lights or emergency flares to warn oncoming traffic. Never attempt to handle a large animal, like a deer, or one who could inflict a serious bite, like a raccoon.
- Call the nonemergency number of the local police department (it is a good idea to program this number into your cell phone) and describe the animal's location. Emphasize that the animal is a traffic hazard and stay put until someone arrives.
- If you try to rescue a small animal yourself, remember the animal may bite or scratch in self-defense. Keep a pair of heavy gloves in your trunk, along with a sturdy cardboard box and an old towel. A paper bag makes an ideal carrier for small birds.
- Use the towel to pick up the animal gently or coax him into the box. Transport him as quickly and quietly as possible to a wildlife rehabilitator. A local veterinarian or animal-care and -control agency may be able to direct you to a nearby rehabilitator, even if neither handles wildlife. If there is a delay in getting the animal to help,

keep him in a quiet, dark, warm place to minimize stress. Do not attempt to give him food or water.

- It is common to see turtles attempting to cross the road, especially during spring. If you can do so safely, help the turtle by moving him across the road in the direction he was headed. (Be careful of snapping turtles, who can deliver a serious bite.) Wearing gloves, hold him firmly on both sides of the shell above the rear legs. Never pick up or drag turtles by the tail, as their backs can be broken this way.

It is important to increase public awareness of the crisis of wildlife on roads. The HSUS's *Give Wildlife a Brake™* program seeks to focus attention on the impact roads have on wildlife habitat and on driving with wildlife in mind.

Wildlife and Development

Habitat loss and fragmentation and the impact on wildlife arising from land development are crucial issues that affect individual wild animals as well as entire populations. It is important to incorporate protection of habitat and wild animals into the land use planning process. This is not just the responsibility of developers and planning officials but also of citizens, who will live with the consequences long after the developers and officials are gone.

Advocates of wildlife and habitat protection should become familiar with existing comprehensive plans and get involved in local planning processes. Good planning can use a variety of strategies, resources, and design features to lessen the impact of development on wildlife. These include consensus planning, public education, developer incentives, conservation easements, conservation subdivision design, density transfers, transfer of development rights, changes in road standards, buffers, mitigation banking (primarily off-site to create larger, contiguous habitats), municipality or county fee waivers in exchange for equal contributions for conservation or wildlife purposes, and current-use taxation programs, which target wildlife habitat specifically. The more you know about these instruments, the better your ability to advocate on behalf of wildlife during the development process.

Successfully integrating wildlife concern into development decisions begins with community plans (sometimes called "master plans" or "comprehensive plans"). Become familiar with your community's master plan and get involved when new plans are written or old ones are revised. Citizens are often invited to be part of planning efforts. You can use that opportunity to promote wildlife as an asset to be protected and encourage habitat conservation when land is developed. Be willing to participate in an open process from which all involved can benefit rather than merely try to block developers.

Wildlife and Development: Getting Started

- *Attend your next local planning meeting.*
- *Review your jurisdiction's comprehensive plan, if available.*
- *Join or form a wildlife group that will work with planning staff.*
- *Get copies of existing laws pertaining to wildlife.*
- *Become familiar with zoning codes.*
- *Ask to be put on a mailing list to receive that planning staff's newsletter or information about upcoming hearings and meetings on development projects.*
- *Research further the strategies and techniques to incorporate habitat conservation into local projects.*

When a developer proposes a project, the specifics are expected to fit the general requirements of the local plan. But, with a little extra care and thought, that plan can incorporate provisions that can help wildlife. One example: removing trees and other vegetation at times of the year when the impact on nesting birds and mammals will be minimized. Where a partnership among state wildlife agencies, advocates, and developers allows for a removal and recovery plan that is biologically sound, some developers have allowed advocates to search for and remove especially vulnerable animals (box turtles are one good example).

People will continue to alter the landscape and affect the wildlife with which all share the land. People who care about wild animals cannot leave decisions solely to the development community and government land-use decision makers. Participate in the planning process and work cooperatively with other stakeholders to ensure that wildlife needs are recognized and accommodated when your community determines how, where, when, and what to build.

Wildlife Sanctuary

Resolving conflicts with wildlife is not always a homeowner's first concern. More often than not, it is seeking out interactions and experiences with wild animals. Bird watching and feeding are popular pastimes, and gardening to attract wildlife, creating backyard ponds, and installing shelters to attract desirable species are gaining steadily in popularity.

The HSUS offers two programs to help property owners protect their land while offering safe and welcoming habitat for wildlife, the Urban Wildlife Sanctuary Program and the Wildlife Land Trust®. Some properties may qualify for both programs, and such combined participation is welcome. Both programs deliberately focus on protecting the homes of all wildlife in diverse settings.

The membership-based Urban Wildlife Sanctuary Program confers honorary certifications on properties whose owners commit to providing useful wildlife habitat and following humane stewardship principles in caring for their resident wildlife populations. In a world where viable wildlife habitat continues to be developed at alarming rates, the program's goal is to encourage understanding and enjoyment of wildlife. Property size and location are unimportant: despite its name, the Sanctuary program is open to all comers, whether their properties are urban, suburban, or rural, whether they own several rustic acres or a city apartment balcony. The core requirements are a sincere desire to enhance habitat on the property and a willingness to commit to pursuing humane approaches to resolving conflicts with wildlife. Among other benefits, members may receive an attractive metal yard sign proclaiming their property an "Official Urban Wildlife Sanctuary" and a subscription to *Wild Neighbors® News*, The HSUS's quarterly newsletter.

The HSUS Wildlife Land Trust provides protection to wildlife through a variety of legal mechanisms that seek to permanently preserve natural habitats. The Trust protects properties ranging from coastal wetlands to deserts, from plains to mountains to rainforests. Each shelters a diverse community of wildlife, and, on each, those animals are completely protected. The means by which the Trust protects property are as diverse as the sanctuaries themselves. In some cases the Trust owns the habitat outright and takes on all the responsibilities of that ownership. Other habitats are protected by conservation easements, agreements that set out permanent legal restrictions on the use of the property. For non-U.S. holdings where other legal tools are not available, the Trust relies on wildlife management agreements and partnerships with like-minded organizations.

Where property owners want to establish a permanent, legally enforceable wildlife sanctuary, The HSUS works with them and their advisors (such as accountants, lawyers, and appraisers) to craft legal restrictions that insure the property's protection. Recreational and commercial hunting and trapping are prohibited; this prohibition is so central to the Trust's mission that it is non-negotiable.

After taking the steps to insure that a

property has legal protection, The Wildlife Land Trust monitors and enforces that protection. Consistent with The HSUS's abiding interest in the protection of all wildlife, the Trust staff work on large national and international projects and protect small properties. For Trust donors and the wildlife their lands protect, this offers the best of both worlds.

Resources

Birds and Windows

Editors Catherine Rich and Travis Longcore have brought together a number of expert contributions in *Ecological Consequences of Artificial Night Lighting* (Island Press, 2005). For those interested in more technical information, we recommend any of a series of articles by Daniel Klem, Ph.D., of Muhlenberg College, who has been recognized as a leader in the scientific study of bird-window collisions for many years. These include

- Klem, Daniel, Jr. 1989. Bird-window collisions. *Wilson Bulletin* 101: 606–620.
- Klem, Daniel Jr., David C. Keck, Karl L. Marty, Amy J. Miller Ball, Elizabeth E. Nicu, and Corry T. Platt. 2004. Effects of window angling, feeder placement, and scavengers on avian mortality at plate glass. *Wilson Bulletin* 116: 69–73.

Several programs focus on the issue of fatal collisions during migration and initiatives modeled after Toronto's Fatal Light Awareness Program (FLAP). See *www.flap.org* for information on this program and *www.birdsandbuildings.org* for information on the innovative program in Chicago. The New York City Audubon Society is spearheading a birds and windows initiative that hopes to produce a major design change in glass that can help protect birds in flight. Visit its website at *www.nycaudubon.org/home*.

Bird Attacks Window!

Sometimes an ardent defender of a territory sees his reflection in a window and determinedly attacks his "rival" until both he and the homeowner are exhausted. Sheets of paper taped to the inside of the window may provide relief temporarily, but they defeat the purpose of having a window, and the bird often simply moves to the next window and resumes his defense. Mylar tape hanging in front of the window may work well enough to get through the season with the hope that maturation or just plain exhaustion will turn the bird's attention elsewhere. This behavior is typically limited to the breeding season, so while annoying, it won't last forever.

Specialty devices to deter birds from hitting windows are described at:

www.windowalert.com
800-773-2753

www.birdbusters.com
800-662-4737.

Finally, this company makes a screen to be mounted outside a window to prevent birds from flying into the glass:

www.birdscreen.com
717-445-9609.

Wildlife as Pets

Information about the issues of wild animals being captured, imported, traded, and kept as pets is available at *www.hsus.org/wildlife-nopets*. The HSUS manual *Reptiles as Pets: An Examination of the Trade in Live Reptiles in the United*

States (Joseph Franke and Teresa Telecky, The Humane Society of the United States, 2001) thoroughly covers the issues for reptiles and can be ordered from the site above.

The Captive Wild Animal Protection Coalition (CWAPC), a consortium of zoo professionals, sanctuary operators, and animal protection groups founded in 2002, works to end exploitation and suffering of wild animals in captivity. By influencing public policy on possession, use, and trade, CWAPC seeks to improve animal welfare while working to end possession of wild animals as "pets." Reach CWAPC in San Carlos, California, at 650-595-4692 and *www.cwapc.org*.

Wildlife and Roads

Richard Forman and his co-editors have brought together a wealth of information on roads as a conservation issue in *Road Ecology: Science and Solutions* (Island Press, 2003).

Information on the roadside reflectors in use in a number of communities throughout the country is available from the Strieter Corporation:

www.streiter-lite.com
309-794-9800.

Wildlife and Development

For an in-depth look at conservation subdivisions, including case studies and model zoning and ordinance language, consult Randall Arendt's *Growing Greener: Putting Conservation into Local Plans and Ordinances* (Island Press, 1999).

Sanctuaries and Attracting Desired Wildlife

The Urban Wildlife Sanctuary program of The HSUS is on the Web at *www.hsus.org/sanctuary*, and the Wildlife Land Trust can be reached at *www.wlt.org* or by calling 1-800-729-SAVE.

8

Tools and Tactics

SPECIFIC TOOLS AND TACTICS CAN be used to resolve wildlife conflicts without resorting to lethal means. They can be organized into three basic categories: (1) prevention, (2) eviction/exclusion, and (3) aversive conditioning. In practice, these often can merge and overlap, as when a single strand electric fence is used more for aversive conditioning than for exclusion purposes, but usually the use and meaning of a specific technique or product is clear.

Consider the perennial problem that many homeowners face: raccoons getting into the trash. Prevention, obviously, is the preferred strategy—putting the trash cans out at the curb the morning of collection, after the nocturnally active raccoons have finished their foraging, rather than the night before. Because weekday mornings are hectic or trash pick up starts at dawn, many homeowners can't—or won't—do this every week. The next best solution is to find the most secure trash can available and exclude raccoons from access. Tight-fitting lids on galvanized cans might do the trick, or bungee cords securing the lid, or, if available, one of the newer trash can designs with a screw-on lid that raccoons just can't figure out. Problem solved. The raccoon, who is only trying to secure a meal, might even not come around any more at all, knowing that she is not going to be rewarded at this house.

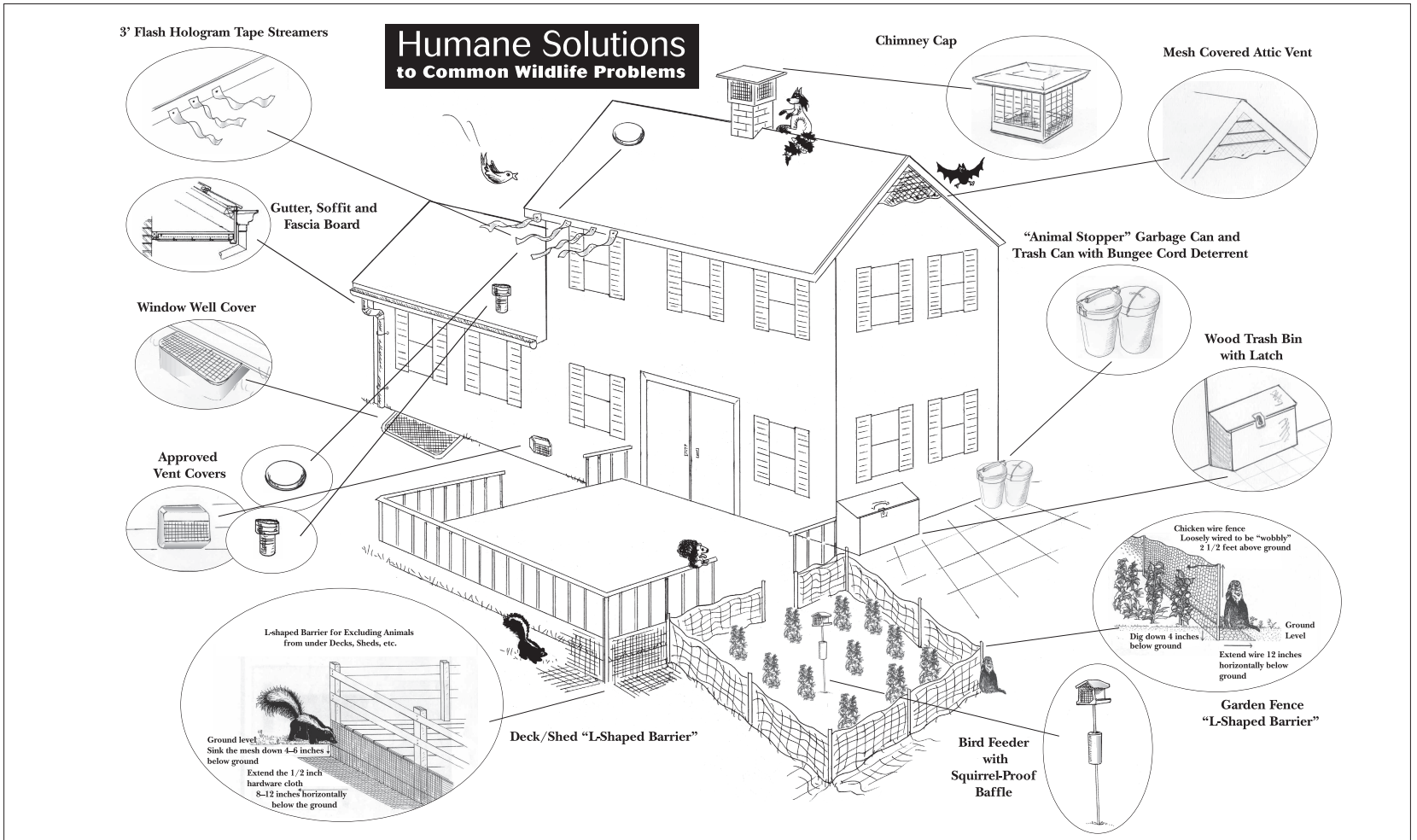
But what if this isn't an option for you? Perhaps you live in an apartment complex with large dumpsters that are always open and into which raccoons can easily climb. The problem truly gets harder now, and, unfortunately, this is where many people give up and hire a trapper to come and take the animals away, usually to be killed or released in unfamiliar territory where they may not survive. The logic behind such practices is flawed. New raccoons will move into the habitat as long as the trash problem has not been solved. This is a *trash* problem, not a *raccoon* problem. It should be solved by managing the trash, not the raccoons.

(A word of caution. As useful as the resources and procedures described here may be, they still might cause real harm if used inappropriately. Remember that the first rule of engagement with wild animals is that when they are not causing damage or harm they should be left alone.)

Prevention

Figure 9 illustrates some of the more common places around the house and yard where routine inspection and monitoring can pay big benefits in heading off potential wildlife problems. In virtually any house, structural breakdowns often invite wild animals to move in. Common points of entry need frequent checking.

Here are some of the places where wild animals might get into structures and where periodic inspections and repairs go a long way toward saving you future expenses (information for which we thank Brad Gates). A thorough inspection should be undertaken at least twice a year, and can be part of a routine



JANET CHILDS

Figure 9 *A few simple and inexpensive fixes to the average house can go a long way toward preventing conflicts with wild animals. Biannual, if not more frequent, inspections are recommended.*

fall and spring home repair and energy conservation plan. Table 2 (page 51) lists the dimensions of building openings that different wildlife species might use to gain entry. These should be kept in mind when performing a home inspection (Figures 10, 11).

Roofs

- Make sure the chimney is capped, and the cap is in good repair.
- Replace curled, worn, or missing shingles.
- Inspect all roof vents and secure perimeters with heavy screening if necessary.
- Remove debris (leaves, etc.) from gutters (or "eaves troughs," if you live in Canada) to prevent water overflow that can lead to wood rot.
- Check downspouts for signs that animals have been using them to climb (muddy paw prints); check TV antennas as possible points of access, too.
- Check all attic vents for signs of entry and install heavy screening if necessary.

Overhang

- Cover with heavy screening any soffit vents located near gutters, downspouts, or other points of access animals could use.
- Trim back overhanging branches six to eight feet, if possible.

Walls

- Check stove and bathroom vents: install heavy screening on existing covers if bird problems are suspected.
- Screen any other existing gaps with hardware cloth or fill with copper mesh or foam insulation.

Foundation

- Screen or cover window wells; check existing covers to make sure they are in good repair
- Check where plumbing and electrical leads enter the house for gaps.

Beyond fixing and maintaining structures, keeping up with yard chores can help minimize wildlife problems. Keeping yards clean, recognizing and removing plant foods or harborage that unwanted wild animals might use, trimming weeds or tall plant growth around building foundations, raking up apples or other fruit that fall onto the



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Figure 10 *Sometimes an animal may gain entry at a point that cannot be seen from the ground. Here a raccoon family is in residence in a place the homeowner could only have found by thoroughly inspecting the home from above as well as below.*



THE HSUS

Figure 11 *Where it looks like an animal has worked to gain entry, especially where evidence of gnawing occurs, suspect squirrels. Be prepared for anything, since raccoons will take advantage of work done by others to move in as well.*

ground, and relocating old wood piles can remove attractions and cover for wild animals if they are perceived as problems.

Exclusion

Many of the measures described above—a lid placed on a garbage can, a fence around a yard or garden—are forms of preventive exclusion. Exclusion can be a lasting and humane way to deal with wildlife conflicts, but it is also a difficult technique to apply when wild animals already present a problem.

There are some general considerations to keep in mind when attempting to exclude animals from any structure. These apply to do-it-yourself evictions as much as to professional removal. Wild animals will not willfully threaten or try to harm people or their property. They are simply interested in surviving and finding shelter, food, or a secure place to give birth and raise their young. Before you attempt any exclusionary activities, it is important to correctly identify the species involved. Misidentification is common and can lead to ineffective or injurious attempts at exclusion. If you observe the animal and can identify it, obviously, that is best. Tracks are also a good way to identify animal presence, but reading them takes some skill. On hard surfaces or in dry weather, flour, garden lime, or another suitable powder can be used to record prints. There are several excellent guides available to identify animal tracks, and a wealth of visual and written information is available on the Internet.

The best strategies take advantage of the natural behavior patterns of the species causing the problem. The more you know about the species involved, its daily and seasonal routines and biological requirements, the more likely you will be able to resolve conflicts humanely.

Exclusionary devices are both generally applicable and species-specific. To locate sources for products not easily found in your local hardware or home supply store, consult appendix B.



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Figure 12 *Simple, inexpensive, and effective, these bungee cords keep the lid on and raccoons at bay.*

Animal-Resistant Trash Containers

In most cases simple latching or holding devices (bungee cords, rope tie-downs, or weights) will secure cans adequately (Figure 12). Newer trash can designs incorporate screw-on lids that are more effective at keeping animals such as raccoons out of the trash than are older designs. Commercial lockout systems especially designed to thwart large and powerful animals, such as bears, are also available.

Bafflers

A baffler is any device that physically keeps an animal away from something you want to protect, such as a birdfeeder or birdhouse. Cones and tubes that attach to poles supporting bird feeders are bafflers. So are the small tubes designed to fit over the openings to birdhouses and prevent predators from reaching in to snatch baby birds. The term also is used sometimes to refer to piping systems that control the height of water behind a beaver dam, but we prefer to call these flow devices (adopting wildlife biologist Skip Lisle's terminology).

Bird Wires or Roost Inhibitors

Various wire devices are used to keep birds away from buildings or other structures. Single strands of galvanized or stainless steel wire (18- to 20-gauge) strung three to four inches above a railing or ledge can be highly effective in preventing pigeons, house sparrows, and starlings from landing. The lines are anchored to eyelet screws (or the like).

They are kept taut by support posts placed every few feet, as well as by hooking the wire onto small springs, which help to maintain tension. As an alternative, a wire coil that looks a lot like the popular Slinky® toy can be wound around or attached to railings or ledges to keep birds from landing.

Products known as "porcupine wire" or "bird spikes" are glued or fastened to ledges and other areas where birds perch to prevent them from landing. In commercial applications, these are generally reserved for difficult sites where problems have been long-standing. There have been claims that porcupine wires caused occasional serious injury to birds, but documentation of this has not been conclusive. Newer versions of this wire, with blunted ends can, we hope, prevent even accidental injury. Porcupine wire may require some upkeep; wind-blown debris can accumulate on it and must be removed.

The "Daddi LongLegs," another wire device designed to protect rooftops and light poles from nesting or perching birds, has long stainless wire "legs" that project out from a fixed base and bend back down in a gentle curve. The legs move and flex in the breeze and swivel around the base. The larger models are intended for use on rooftops, while smaller versions are for the tops of streetlights or poles. A specialty device adopting similar principles is made for keeping gulls off boats.

In any application of bird exclusion devices, you may need a professional to install the product, especially on high-rise buildings.

Excluding Wild Animals from Structures

It is critical to determine whether young are present before conducting any exclusion. Always assume young are present when you consider harassing, excluding, or physically removing wild animals from homes unless demonstrated otherwise.

Bulb Cages and Gopher Baskets

Flower bulbs and plant roots can be protected from burrowing animals by wire cages and baskets, which can be purchased or simply homemade from sturdy flexible wire. Mesh size may vary, depending on the species causing problems and the effect on the plant of having to force growth through sometimes very small areas. Start with one-inch-square galvanized hardware cloth, if you can find it. (You can use one-half-inch square, but monitor the effect it has on plant growth.) The cage or basket is set into the planting hole, and the bulbs or plant placed inside before backfilling the hole. If squirrels are the problem, as they often are, you may get by with a cover only, and it would easier to try this first. In general, we prefer plantings that are naturally resistant to animal tampering, such as daffodils, as any buried hardware cloth will deteriorate over time and may be a nuisance to remove.

Plant Covers

Cloche, French for "bell," describes a bell-shaped glass cover used to protect young plants from frost. These covers can also be used to keep hungry wildlife at bay when plants are most vulnerable (during the first couple of weeks of the growing season). Many people reuse a plastic jug with the bottom cut out—cheaper but less aesthetically pleasing—for the same purpose. (The jug is anchored by partly burying the bottom in the soil.) Row crops can be protected by fabric plant covers and tents or row covers. Both covers and cloches are especially useful where protection is only needed during the early spring. This is the time before natural foods are readily available, and damage from deer, rabbits, or woodchucks can be intense but temporary.

Wire Mesh, Caulking, and Foam Sealants

Caulking materials range from silicone-based fillers to common expanding-foam products. These are used to fill in around wire mesh or to fill entry holes up to several inches in diameter. Pliable wire mesh can be used to fill



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Figure 13 *This fence permanently excludes deer, because of its height, and smaller animals such as rabbits, because of the narrow lower bars, from access to this yard. The homeowners can, and do, grow any plants they want.*

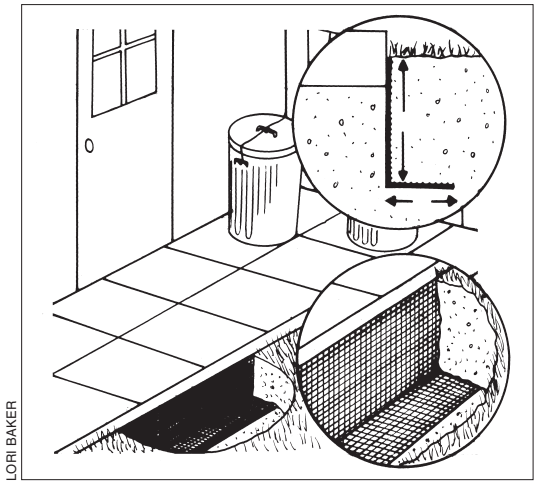
holes, which are then sealed off with caulking or foam. The best material is made of copper: it is basically the copper mesh dish cleaners you see in the grocery store, just sold in larger quantities. It will not rust or deteriorate, and it may inhibit rodent gnawing. It can also be pushed into all sorts of small and oddly shaped openings.

Chimney Caps

Commercial chimney caps are made of painted heavy-gauge or stainless steel. They generally will withstand many seasons of exposure. Both commercial and homemade caps must comply with fire codes and can be deadly if installed incorrectly, so here, as elsewhere, obtain professional installation if in doubt.

Fencing

Fencing is one of the most effective and permanent ways of excluding wild animals from outside areas. Although initially costly, fencing may be the most cost-effective solution over time where damage is likely to recur (Figure 13). The trick is in figuring what kind of fence is needed for a specific situation. Fence height, material, design, and installation can all vary, depending on the species the fence is meant to exclude and other factors, so you should usually seek professional advice. Good local sources might include farm supply



LORI BAKER

Figure 14 *The L-footer can be used to protect any area where a burrowing animal has started to excavate a potential home. L-footers are also used preemptively to protect raised decks. When installing an L-footer, it is necessary to make sure that no animals, especially dependent young, are prevented from getting out.*

stores, fencing companies, or university cooperative extension agents. Some fencing supply companies also include advice and useful information in their catalogues. Community covenants and local ordinances may restrict the type, size, and design of fencing you can install. (Since animals react to electric fencing more as aversive conditioning than as exclusion, it is discussed in the following section).

Animals who take up residence under a deck or crawl space often are capable diggers, and fencing to exclude them should be extended in an L shape to prevent reentry. Ideally such footers are buried a foot deep and extend at a 90 degree angle for up to 24 inches to present a horizontal front. If this is not possible—where foundation plants, roots, or rocky soil are found, for example—the L-footer can lie on the surface instead, covered with soil or mulch. Landscaping "pins" from garden supply outlets will hold these surface footers down securely.

L-footers can be homemade from fencing material or purchased from the sources listed in appendix B (Figure 14). When animals are evicted from under decks and similar locations, this fencing is used with a one-way door that allows the animal to leave but

Table 2 — Minimum Access Area Needed by Common Wild Animal Species Found Around Homes

SPECIES	OPENING (IN INCHES)	COMMENTS
BATS (MOST SPECIES)	1/4 x 1/2	Usually gain access through gaps where materials join, such as siding and soffit.
FOXES (RED AND GRAY)	4 x 4	Gray foxes are good climbers.
HOUSE SPARROWS	3/4 x 3/4	Adept at gaining access to clothes dryer, range, and bathroom vents.
MICE	1/4 x 1/2	Can fit through openings the size of a dime.
RACCOONS	2 1/2 x 4	Can fit through surprisingly small openings; heavier material required to exclude because of greater strength.
RATS	1/4 x 1/2	Can fit through openings the size of a quarter.
SNAKES	1/4 x 1/2	Some snakes fit through smaller openings; if the snake can get his head into the opening, he can get his body in.
STARLINGS	1 x 1	Clothes dryer and exhaust fan vents are a favorite; starlings can lift flaps and get in.
TREE SQUIRRELS	2 x 2	Entry often occurs through screening behind attic vents and deteriorated louvers; may require very heavy exclusion materials because of gnawing ability.
WHITE-TAILED DEER	12 x 24	Deer prefer to crawl under obstructions rather than jump over; a 9-inch or lower wire is recommended on either electric or nonelectric fencing because the animals may crawl under higher wires.
WOODCHUCKS	3 x 4	Under decks and porches; the characteristic mound of earth in front of a hole is an indicator of woodchucks.

Ultrasonic Devices

Numerous products that emit sounds inaudible to humans are claimed to be highly aversive to wildlife species. Often heavily advertised in garden and home improvement catalogues, these products, in our opinion, remain completely unproven. In the future these devices may prove to be effective and reliable, since they have that obvious potential. For the present The HSUS does not recommend ultrasonic devices for wildlife control until properly conducted scientific research can validate the manufacturers' claims of their effectiveness in real-life situations.

not return. (Later chapters dealing with individual species have more specific information on this use). Any such repaired or modified denning area should be examined daily after the animal is excluded to make sure she has not tried to get back in or that others are not trapped inside.

Hardware Cloth and Welded Wire

These workhorses of most exclusion jobs are available in many different sizes at virtually any hardware outlet. Hardware cloth is used to make or repair window screening and is available in fiberglass and galvanized metal with mesh (hole) sizes that range from very fine (1/32 inch) to large (l inch) and come in various gauges (wire thicknesses). The professional standard is one-inch, 16-gauge mesh that is galvanized after being welded. Mesh this size may be difficult to find, and, if other sizes must be used, we caution against going much larger, since small animals might be able to gain entry. Larger animals may have to be excluded with heavier mesh, which usually comes in larger sizes. When it is installed over window screening, welded wire keeps larger animals at bay, while the finer mesh keeps small animals and insects out.

Netting

Netting is being used increasingly to solve many wildlife problems—from unwanted sparrows and pigeons perching on buildings to deer browsing on ornamental plants. Netting is sometimes used in large-scale commercial operations, for example, to protect vineyards from depredating birds. It's also used to make "check valves" to exclude bats from buildings.

The growing popularity of the "invisible" netting material used to protect shrubs from deer raises a potential concern. There are anecdotal reports that birds, snakes, and other animals may blunder into this fine mesh and not be able to get out. We had little documentation of this phenomenon as of 2007 but wanted to offer it as a possibility.

One-Way Doors (Animal Excluders)

These devices will let an animal out of a den or burrow but not back in. Not too long ago, one-way doors had to be homemade; now they are sold in several different sizes. One-way doors can be used above ground on buildings, where squirrels or raccoons are in attics, or at ground level, where woodchucks, skunks, foxes, raccoons, or other animals are getting under decks or patios (Figure 15). Very simple one-way doors for snakes are described in chapter 35. One-way doors



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Figure 15 *This one-way door will let the woodchuck who has taken up residence leave but not return.*

should be used only when the homeowner can be sure that no young animals will be trapped inside after the adults are excluded. When used correctly the doors offer a practical and humane method for evicting animals living in or under a house.

Vent Covers

Birds nesting in dryer and oven vents can be excluded by installing either commercially available or homemade wire or plastic covers. The caution here, as with any exclusion strategy, is not to modify the area so much that it impedes the original function—chimneys must vent gases, dryer vents must allow the flow of air without becoming clogged, even the vents that passively allow air into attics or crawl spaces and are working to meet a specific purpose cannot be entirely sealed off. When in doubt, consult a professional.

Tree Protectors

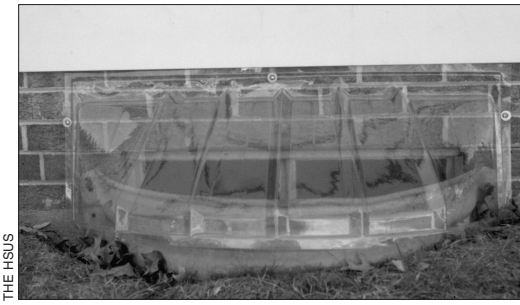
Tree protectors, which are wrapped around tree trunks, are made of wire fencing. Larger mesh is used as protection from animals such as beaver, and finer mesh wrapping, sold at many nurseries, protects younger trees from small animals, such as voles. Their uses are further explained in the chapters devoted to individual species.

Window Well Covers

These simple, inexpensive plastic covers prevent wild animals from falling into window wells (Figure 16). Skunks and snakes are common victims and often cannot get out without assistance. The covers double as insulation and protection from the elements and ought to be used everywhere.

Aversive Conditioning

Aversive conditioning refers to any active effort to "teach" a wild animal to stay out of a given area. It is the same principle as teaching your dog to stay off the sofa or your cat to stay off the kitchen countertop. It can be as simple as stepping out onto the back porch and yelling or as sophisticated as high-tech



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Figure 16 *This simple window cover will keep wild animals from falling in and becoming trapped. Since skunks and snakes are two species to whom this commonly happens, most homeowners readily embrace the idea of preventing access as well as improving insulation for the house.*

electronics that broadcast species-specific distress calls. It has the same chances of success as do the many devices and strategies you may have tried with your cat or dog. (Sometimes life is simple, sometimes difficult, but it should always be humane.)

Common sense tells us there is a limit beyond which frightening or scaring techniques should not be used on wild animals. It is clearly inhumane to harass a wild animal in a way that creates excessive stress—but what is "excessive"? For migratory birds and some species of special concern, federal and state law authorities tell you exactly what is or is not acceptable as a harassment technique. For other species limits, if any, are set by anticruelty statutes. As a general rule, it is inappropriate to harass or frighten a wild animal when he cannot escape from the stimulus or to pursue and use scaring or frightening stimuli persistently. Fright and harassment are not ends or solutions to problems in and of themselves and must always be coupled with other strategies that strive to eliminate the circumstances that caused the problem in the first place.

Creativity has its place in devising aversive strategies, and you may have some tools in your house in the form of simple children's toys or household castoffs that might prove effective. Here are some strategies and devices used for aversive conditioning.

Acoustical Alarms

Commercially manufactured alarms rely on loud noises (sometimes combined with bright lights) to frighten both birds and mammals away from areas where they are not wanted. Hand-sized motion detectors and alarms, intended mainly for indoor use, can be used in attics or crawl spaces or, with proper protection from the weather, in some outdoor situations. Triggered by motion, they set off a loud alarm to frighten intruding animals. These alarms might also frighten or waken nearby humans, so they should only be used where they are not likely to alarm or bother people.

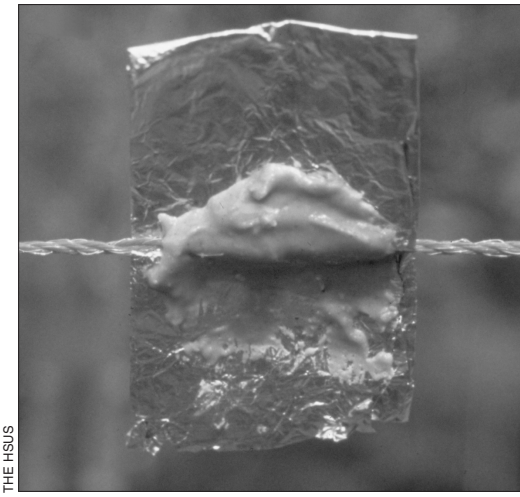
Bird Distress Calls

Tape recordings of the distress calls of individual bird species have been used for a long time to frighten away birds of the same species. More recently, they have taken the form of digital recordings in devices made to work on specific species. Used properly, these can help disperse birds such as starlings and crows from roosts and geese from parks and other public areas. Distress calls should not be used where people could be bothered or inconvenienced. They are most likely to be effective when used in combination with other techniques.

Effigies, Scarecrows, and Kites

Scarecrows are one of the oldest, simplest, and most effective methods of frightening birds; they even work on some mammals. Scarecrows can be as simple as plastic garbage bags or strips of lightweight material tied to a stake in the ground, or as complex as a robotic model that randomly inflates itself to appear as if a human were rising from the earth. Movement is an important element in any scarecrow design, and those that can catch breezes, or are motorized, are generally more effective than stationary ones.

Lifelike replicas of hawks, snakes, and owls are widely marketed as bird-frightening deterrents. The effectiveness of these devices varies with the target species, the type of model, its placement, and the extent to which the device resembles a real predator. Moving effigies are likely to be more effective than stationary ones. Hawk and eagle effigies used as kites can have a real impact on geese, gulls, and other birds in open areas. Regardless of movement or appearance, however, birds can become acclimated to these devices and cease to fear them. The trick to increasing the effectiveness of effigies lies in innovative human use and presentation of the stimulus, as much as in the nature of the stimulus itself.



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Figure 17 *This oddity is a lure made up of peanut butter on a good conducting surface—tin foil—attached to a specially designed electric fence. A curious deer, on investigating this tasty treat, will get a mild shock that teaches him to avoid this area, protecting the garden that the fence surrounds.*

Electric Shock

Farmers have long used electric fencing to protect crops. It even has proven effective in keeping large animals, such as bears, from valuable and enticing resources such as beehives. The principle involves delivering a high-voltage but low-amperage jolt that does not physically harm the animal but delivers a shock unpleasant enough to create a strong negative conditioning response. Because of the great differences in size and susceptibility to shock among species (deer, for example, can be quite resistant to shock because their hooves are relatively good insulators), the exact requirements for effective electric fencing vary greatly.

These fences are potentially dangerous to both people and animals, and they must be used in accordance with any local restrictions or ordinances and common sense. Electric fences should not be used in places where small children or pets could be shocked and must always be well marked with cautionary signs. All electric fences require frequent inspection and maintenance; it is important to keep surrounding areas clear to prevent plants from growing into the wires and shorting them out.

Single-strand electric fences set at an appropriate height can deter species ranging from woodchucks and raccoons to deer and bear. Sometimes the fences work best by attracting the animal rather than by repelling him. The theory is that, by luring the animal in to investigate the fence, he is much more likely to be shocked in a way that conditions him effectively to avoid the general area. For deer or raccoons, affix tinfoil strips to hold a lure (peanut butter for deer, jelly or licorice paste for raccoons) that draws the animal to investigate the wire (Figure 17). Individual battery-charged posts, similarly baited, can attract deer and deliver a lesson. For smaller animals, such as raccoons and woodchucks, single-strand electric fences can be installed in front of nonelectrified fences or other obstacles. The shock is then delivered before the animal is able to climb the larger fence. All-in-one kits offer small gardens and backyard ponds an easy electric fence option.

Polytape electric fencing is also single-strand, but this much wider and more highly visible tape strip is meant to work as a visual repellent as well as a shocking device. Once an animal has been shocked by a polytape fence, he is likely to remember and recognize the highly visible tape and avoid going near it again. The brightly colored tape is also more visible to people. There is probably less maintenance required for a polytape than for single-strand fences simply because the greater visibility of the tape prevents it from being knocked down as often.

Multistrand, high-tensile electric fences are used mostly to protect highly valued resources such as orchards or agricultural crops. These, more than other types of electric fencing, require expertise to install, and we recommend local sources or consultation with the fencing companies listed in appendix B before considering their use and application. Specialty products are made to repel birds, primarily pigeons, from buildings and are sourced in appendix B.

Scare Balloons

Eye-spot balloons have been used for a number of years to frighten birds from fields and open lawn areas and may work well depending on the setting and context. The balloons rely on what is called a “supernormal” stimulus—in this case a highly enhanced “eye” that menacingly occupies the center of the balloon. We’re not currently as enthusiastic about the potential of these devices as we used to be, having experienced firsthand some failures in the field. Movement of the balloons (as with effigies) and repositioning them seem to be important factors. Less expensive and readily available Mylar® party balloons with bright silvery finishes may be equally effective deterrents on a short-term basis. These might be used to frighten any of the variety of birds causing conflicts (waterfowl, starlings, and pigeons being the most

Mothballs

Naphthalene, a chemical used in moth balls, is registered with the EPA as a bird repellent. Paradichlorobenzene, another commonly used ingredient in mothballs, is registered for use in the form of Varpel Rope, but not for use outdoors in mothball form. Besides most likely being ineffective in such a context for any species, these white "candies" could be a danger to any children putting them in their mouths. Consider all of the implications of using a product as well as what the label says you can and can’t do with it.

common) and deer, skunk, foxes, and (perhaps) raccoons. For a dollar or two of investment, a party balloon maybe worth a try.

Scare Tape

Mylar® tape is a strong laminated metal and plastic material that was originally developed for use in the NASA space program. It is highly reflective and can create a dazzling pattern of light when in motion (Figure 18). A holographically imprinted version has even greater light-reflecting properties. Cut into strips of varying lengths and widths, this tape can be hung in streamers from posts, wires, house gutters, or anywhere else the homeowner wishes to repel animals. It can be twisted and strung to make a temporary fence that, while not sturdy enough to keep animals out, can frighten them away. As with other harassment tools, it may be most effective when used in combination with other strategies. It is less effective on cloudy days and at night; however, whenever it can be set up to catch occasional flashes of light it should work.

Mylar® tape has been incorporated into a number of variants on the basic concept, including devices that rotate or flap in the wind and combine the signal properties of motion and brightness. Unpredictability and motion are key requirements for any visual frightening device.

Sprinklers

The ordinary garden hose with a power nozzle attachment has long been used to scare away unwelcome animals. The difficulty has been that the homeowner has to see the animal, and the animal has to be fairly close. A second-generation device combines a motion sensor with an oscillating sprinkler (Figure 19). This sentinel can sit quietly in a yard or garden for hours waiting for an offending creature to draw near before coming to life with an energized blast of water. The main drawback may be its somewhat hefty price tag, as well as the possibility that homeowners given to forgetfulness may be its victims as often as the intended target species.



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Figure 18 *Mylar® tape reflects light in a way that causes birds to avoid it. From protecting vegetables in the garden to preventing window strikes, this tape is one of the most versatile tools in wildlife conflict resolution. Here it kept curious crows from pecking through the plastic cover on this cold frame.*

Lights and Lasers

More and more high-tech devices are coming onto the market every year, including such sophisticated electronic devices as motion-sensitive lights, strobes, and lasers that find use in wildlife-control work. Motion-sensitive outdoor lights are probably the most economical, as well as practical, aid, since they can scare animals as well as alert the homeowner to the possibility of deer, raccoons, or other animals in the yard. An added benefit could be in the exercise the homeowner gets while going back and forth to the window to see what has set the light off "this time."

High-powered lasers are used often now to deter birds, such as geese, from occupying sites where they are unwanted. The focused light is not directed at the birds but at the ground or water they are resting on; as it scatters and diffuses, it creates a stimulus that causes high alarm. Strobe lights have more limited application and use, but research to determine if they can repel birds from airplanes' flight paths is encouraging, and the information that might come from such studies eventually could be applied elsewhere.



Figure 19 *This oscillating sprinkler is activated by a motion-sensing device to send a blast of water in the direction of any moving object triggering its sensor. It can help keep a variety of wild animals, not to mention the occasional cat, dog, or person who violates its protective radius, away from protected plants.*

Chemical Repellents

The use of a chemical compound to deter wild animals humanely is appealing to many people, and it is difficult to disentangle this appeal from an objective assessment of the compounds' effectiveness. (We thank Russell Mason, Ph.D., a leading expert on repellents, for contributing the following technical summary.)

Chemical repellents have been used to protect crops and gardens for centuries. Formal scientific investigations of these substances, sought as rodent and deer deterrents, started in the first half of the twentieth century. Generically, chemical repellents are irritants or odors that wildlife avoid or tastes that wildlife refuse to consume. A variety of deer, rodent, canine, and bird repellents are commercially available. Others can be concocted at home, following recipes and application instructions widely available in gardening manuals. Examples of home remedies include soap (particularly those advertised as having a "fresh scent"), human hair, household ammonia, and "hot sauce." Commercial repellents typically incorporate capsaicin (the active chemical in hot sauce), various higher fatty acids (cheese- or fish-like odors), bone tar oils (decay odors), bitrex (denatonium salts or acids that taste bitter to humans), or urines.

With the exception of hot sauce, few home remedies actually work. Soap and human hair sometimes confer limited (weak) short-term protection but otherwise are of little use. Among commercial repellents, those containing capsaicin, bone tar oil, or higher fatty acids can prevent animals from eating the treated plants.

No repellent currently available will always prevent animals from entering, crossing, or living in treated locations. Despite marketing claims to the contrary, there is no such thing as an area repellent. In many cases, the principle benefit of chemical repellents may be psychological; they give users greater peace of mind. Perhaps for this reason, repellents' marketing strategies often feature anecdotes and testimonials, rather than science. Products marketed this way should be viewed with suspicion. The lack of dependable information reflects the fact that the Environmental Protection Agency (EPA) often does not require repellent manufacturers to prove they actually work. Instead, the agency requires evidence that repellents are environmentally benign.

In situations where repellents might work, following a few guidelines greatly increases chances for success.

- Apply repellents at the first signs of damage or before expected damage is observed.

- Reapply repellents regularly, especially after rain or snow.
- Apply repellents directly to the items that need protection and not to entire areas.
- Apply repellents when it is clear that wildlife have other foods available to them (e.g., other plants to browse, fruit to consume, etc.). If no other food is available, hungry animals will eat whatever they find, even plants treated with a repellent that would deter them under other conditions.
- Recognize that season of the year is important; repellents are unlikely to work in late winter or early spring when little alternative food is available, unless they are combined with other strategies such as physical barriers.

In general, repellents fall into two broad classes: those that are physically irritating and those that alter palatability (taste). Both classes are most effective when used to prevent animals from eating or chewing treated items such as food or electrical wiring. Contact with the animal's mouth and nasal passages is key.

Pain (Irritation)

Among chemical repellents, substances that cause pain have the most immediate effect. This is because pain elicits immediate avoidance independent of learning and because repellency does not diminish as long as the repellent chemical is present. Irritants are not simply "bad" tastes or smells; they stimulate specialized pain receptors in the exposed mucous membranes of the eyes, mouth, nose, and gut. For mammals, including humans, capsaicin, capsicum oleo resins, and volatile chemicals such as mustard oil and ammonia are strong irritants. These are the active ingredients in commercial hot sauce products and many deer and rabbit repellents.

Bitter and acidic substances are rarely, if ever, effective feeding deterrents. While they can reduce the consumption of treated materials slightly, wildlife acclimate to them within a short period. Products that claim to work because of a bad taste are doing so largely (if not solely) in the absence of evidence.

For birds, methyl anthranilate (a chemical in Concord grapes) is an effective irritant at concentrations that are inoffensive to most mammals. This chemical has a fruity or floral odor to humans (and presumably to other mammals) but is highly irritating to birds, highlighting a fundamental difference in how these groups' nervous systems perceive irritants. In general, substances that irritate mammals are inoffensive to birds and vice versa. Capsaicin, for example, is an extremely effective irritant for mammals and works even in concentrations as low as 1–10 parts per million (ppm). Birds, on the other hand, tolerate capsaicin concentrations as high as

Electric Shock

The HSUS supports the use of nonlethal, non-invasive techniques to minimize human-wildlife conflicts. We realize, however, there are certain situations where these techniques may cause temporary pain or stress, as, for example, in the use of electric shock to condition animals negatively to avoid places where they are particularly unwelcome. Such techniques, which are only appropriate when undertaken in a responsible manner, may require trained and qualified professionals to ensure proper application. It is imperative that such measures do not cause severe or lasting harm, are safe for humans, provide negative conditioning only when and where less invasive procedures have failed or will demonstrably not work, and when and where the only remaining alternatives, such as translocation or killing, would be far less desirable.

20,000 ppm in drinking water. Likewise, mustard oil (allyl isothiocyanate, the active ingredient in tear gas) is extremely irritating to mammals, provoking intense short-term tearing and difficulty breathing. However, when open vials of mustard oil are placed in starling nest boxes, birds build more nests, lay more eggs, and hatch more nestlings. This surprising effect likely is because mustard oil is an insecticide and fumigant against pathogens and parasites in the nest boxes but is not a bird repellent.

The great disadvantages of irritants as wildlife repellents are that animals do not learn to avoid treated materials and, at least for mammals, irritants affect all species at about the same concentration (i.e., if the irritant concentration is too low to affect humans, it is unlikely to affect wildlife and vice versa). For reasons that remain unclear, wildlife continually "test" treated materials and resume feeding once irritant concentrations diminish. Also, the effectiveness of irritant repellents varies depending on the context (where and when) and crop where they are used. Although several brands and formulations are sold to repel a variety of birds (starlings, blackbirds, cowbirds, gulls, Canada geese, mallards) from a number of crops (apples, grapes, cherries, blueberries, corn, sunflower, rice, turf, ornamentals) and settings (e.g., lawns, ponds, indoor areas), there is still a need to show how effective these different applications are under different conditions. For substances such as methyl anthranilate and capsaicin, there is also the possibility treated food crops will taste off-flavor to people.

Palatability

Animals usually avoid tastes that are followed by sickness, at least temporarily, an effect called conditioned avoidance. Conditioned avoidance can occur after a single negative experience, particularly when sickness is great and the taste or food is new. It is much harder to condition wild animals to avoid a taste or a food they are already familiar with.

Conditioned avoidance protects crops. It is the mechanism that makes methiocarb (Mesurol) work as a bird repellent and disulfram (Thiram) as a bird and mammal repellent. It has also been tried on coyotes to control preying on livestock and on bears to teach them to avoid garbage dumps. Neither of these attempts has been especially successful, although the latter has not been researched as thoroughly. (It may be possible to train bears to avoid specific garbage cans.) At present, there are few conditioned avoidance products on the market, although disulfram (Thiram) is still sold as a deer repellent. This reflects the expense and difficulty of registering and maintaining the registration of vertebrate pesticide chemicals with the EPA. Disulfram is chemically similar to Antabuse (a drug used to help alcoholics stop drinking) and can be absorbed through the skin. People who drink alcohol soon after applying disulfram have become ill as a result.

Combinations

Repellent combinations may be more effective than repellents with single modes of action. It makes sense intuitively that irritation and gastrointestinal malaise would provoke stronger avoidance than either alone. For example, a mixture of capsaicin (pain), disulfram (sickness), and Big Game Repellent (carnivore diet) might be considerably more effective as a deer repellent than any one of these substances would be alone. For birds, anthraquinone is a commercial repellent that probably has negative sensory (visual, as it is perceived by birds in ultraviolet spectra) and post-ingestive (causing malaise) effects.

The caveat on combination repellent products is that each of the components needs to be present in biologically significant concentrations. This is frequently not the case. For example, some deer repellents contain egg solids and capsaicin. While both ingredients are repellent to herbivores at appropriate concentrations, the capsaicin concentration in these mixtures is very low. For this reason, the mixture may be no more effective than egg solids alone.

The Bottom Line on Repellents

Irritation is a more effective repellent principle than conditioned avoidance, and conditioned avoidance is probably a more effective repellent principle than predator avoidance. Regardless, the effectiveness of any repellent is affected by (1) the number and density of animals causing problems, (2) the alternative food available, (3) the desirability (to the animals) of the treated material, (4) weather conditions, and (5) the concentration of active ingredients the target animals experience. Because of these factors, chemical repellency is always relative and thus always susceptible to failure. Given sufficiently high numbers of animals and sufficiently few food alternatives, repellents will fail. Repellents are not a standalone tactic to resolve wildlife conflicts; they can be most effective when combined with other methods such as those described in the earlier sections of this chapter.

Population Control

Often, conflicts with wild animals in urban and suburban environments are attributed to "overpopulation" of a given species, such as white-tailed deer and Canada geese. These and other animal generalists who thrive in towns and cities often do so well that their populations grow rapidly enough to appear explosive. But "overpopulation" is a relative concept, and wildlife biologists today are quick to distinguish between the numbers of animals that can be supported physically on a given piece of land (the biological carrying capacity) and the numbers that people are willing to tolerate (the social or cultural carrying capacity). Conflicts between people and wildlife start when animal numbers cross the social carrying capacity threshold, which often is far lower than the threshold for biological carrying capacity.

One of the most controversial issues with wildlife today surrounds "controlling" populations labeled "overpopulated" or "overabundant." The HSUS has led national and international efforts in developing approaches for humane population control. Currently, these fall into two broad categories: contraception, used in mammals to prevent pregnancy, and egg addling, used with birds to prevent hatching. Others are developing reproductive controls as well. In particular, a drug (nicarbazin) to prevent birds' eggs from hatching has been registered by the EPA for Canada geese and pigeons and should be available soon for other species as well.

By whatever method, limiting population growth requires a long-term effort to make significant inroads in population size. It can also show results in the short term when fewer animals are using a problem site to raise their young the season after the method was applied.

Contraception

The idea of using contraception to limit the growth of animal populations has been around for more than a half-century, but rarely championed outside the animal welfare and protection community. Since the 1980s, The HSUS has focused on developing immunocontraception, a vaccine-based birth control method that uses the body's immune response to prevent pregnancy. The HSUS's immunocontraception programs now encompass a range of research projects around the world, with free-ranging white-tailed deer, wild horses, elephants, water buffalo, domestic animals, such as dogs, and more than 150 species of zoo animals.

Virtually all of The HSUS's immunocontraception studies use the PZP (porcine zona pellucida) vaccine administered by dart or hand injection. PZP is a protein in pig ovaries (the small amount of protein used in this research is collected from pigs already destined for slaughter; no pigs are killed for the sole purpose of making PZP). In field studies the vaccine has proven highly effective and reversible; it does not pass through the food chain or negatively affect the health or behavior of treated animals. The HSUS is also strongly advocating for and funding the development and humane testing of synthetic contraceptives so a safe, economical immunocontraception option can be available for large-scale use.

Public attention has turned to contraception as the solution to deer-human conflicts in recent years as word gets out about our successes. The HSUS receives numerous inquiries annually from interested parties who hope for a cure for deer-human conflicts. While immunocontraception holds promise for the future, this tool is still in its developmental stages, and it is only one tool. Immunocontraception can ultimately be one of several management alternatives, but it is not a "magic bullet" to control every problematic free-ranging wildlife population. Political and bureaucratic obstacles must be overcome, including the long process of testing and approval for the vaccine and resistance to using contraception as a management tool from some state wildlife agencies. (They may be concerned that revenues derived from deer hunting in particular will fall.) Still, we remain optimistic about the future of wildlife contraception.

Egg Addling

Addling, which means "loss of development," is commonly used to refer to any process that makes an egg unviable. Addling can occur naturally when incubation is interrupted for long enough that the egg cools and the embryo stops developing. People addle eggs to limit reproduction of species causing conflicts. Older methods of shaking or piercing eggs to physically destroy egg contents have been replaced by oiling eggs or simply removing them from the nest and allowing them to cool. Addling has been used to limit reproduction of a variety of bird species: gulls, to protect eggs and chicks of endangered terns; mute swans, to limit their claimed impact on aquatic plants; and, most extensively, Canada geese, to limit the growth of flocks in urban and suburban areas.

To be humane, it is imperative to addle eggs in the earliest stages of development. When an air sac develops inside the egg, the embryo is typically too developed for addling. The HSUS has a written protocol for Canada geese that details how to addle eggs of this species humanely. Other species have different nesting chronologies and incubation periods, so an addling protocol must be developed for each species.

Addling Permits

Egg addling for any species except those exempt from the Migratory Bird Treaty Act is regulated by federal and state wildlife agencies; be sure to check any regulations that might be applicable in your state before even considering use of this technique.

Resources

Repellents

Because the brand names and even formulations of repellents change frequently, we recommend web-based searches for current information, or a visit to your local household supply store or plant nursery. Often a conversation with a local nursery manager or salesperson can provide the best advice and direction about what products are working in your area. More information on the science of repellents can be found at this site: *www.aphis.usda.gov/ws/nwrc/* and we mention a couple of specialty products as well in appendix B.

A broader look at the role of immunocontraception in wildlife can be obtained by reading *Humane Wildlife Solutions* (Allen Rutberg, Ph.D., editor, Humane Society Press, 2005). A PDF version of this book is available through the Humane Society Press website, *www.humanesociety.org/hspress*.

Part 2

Our Wild Neighbors



9

ALLIGATORS

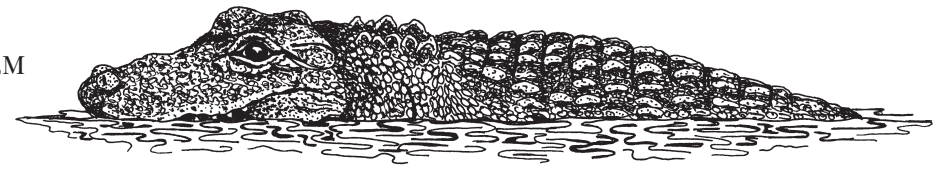


Figure 20 *Alligator*

IT MIGHT SEEM surprising that the American alligator was once highly endangered, given that the Florida Fish and Wildlife Conservation Commission now receives ten thousand complaints about alligators annually (Figure 20). Once hunted nearly to the brink of extinction for their skins, alligators rebounded under protective laws until now, an estimated two million of these animals are living in the wild today. The status they hold as threatened is to help protect crocodiles, close relatives who *are* truly endangered.

Most people confuse alligators with crocodiles, even though the latter are only found in extreme southeastern Florida along the coast. Crocodiles can subsist in saltwater habitats; alligators are better adapted for freshwater living. Most species of crocodiles have narrow, "V"-shaped snouts. Alligators' snouts are rounded and shovel-shaped.

With their formidable size and powerful jaws, alligators are intimidating animals to encounter. However, your chances of being injured by an alligator are slim: you are far more likely to be injured while boating, water skiing, or scuba diving. Alligators, however, can be a real threat to free-roaming dogs or

- **The low-frequency vibrations made by a male alligator just before his audible bellow are so powerful they can make the water "dance" in a visual display of droplets.**
- **Although alligators have existed unchanged for so long that they are given the title "prehistoric," there is nothing primitive about these sophisticated, complex animals.**
- **In winter, alligators excavate "gator holes" for refuge, and the water retained by these holes helps to support many other aquatic animals through the southern winter.**

livestock allowed to approach the waters within an alligator's territory.

Classification and Range

The American alligator (*Alligator mississippiensis*) is the largest native reptile in North America. Females are generally less than nine feet in length, but males can reach sixteen feet and weigh more than five hundred pounds. Alligators live in the southeastern United States, ranging from east Texas on the western side of their range to North Carolina and Florida in the east. The largest populations are found in Florida, Louisiana, and southern Georgia.

Habits

"Alligator" comes from the Spanish *el lagarto*, which means "the lizard." The skin on an alligator's back is armored with rows of bony plates called osteoderms or scutes. Alligators have an elongated, rounded snout, with nostrils at the tip to allow breathing while most of the body is submerged. Alligators have poor eyesight; they do, however, have an excellent sense of smell. Adults are dark with pale undersides, while the young have bright yellow stripes and blotches.

Alligators are found primarily in freshwater swamps, marshes, shallow lakes and creeks, and the wetlands that surround these areas. They occasionally inhabit brackish water. Alligators excavate burrows with their tails and snouts in ponds and shallow water holes. The resulting silt that is pushed onto the banks provides nutrients for a variety of plant life. These "gator holes" are a vital part of the wetlands ecology.

Alligators are very temperature sensitive and require good dens to survive extreme heat or cold. Temperatures above 95 degrees Fahrenheit (F) or below freezing can be deadly. Alligators are not true hibernators, but during these extremes they become largely inactive while waiting for better temperatures.

Alligators are opportunistic feeders and generally feed at night. They will attack almost any appropriately sized prey that comes within range. These include fish, birds, turtles, snakes, and small- to medium-size mammals. They will also eat road-killed animals or other carrion available close to waterways. Because reptiles need external heat to aid digestion, alligators are most likely to feed when water temperatures are 70 degrees F and above and are unlikely to feed when water is in the mid-60s or below. Alligators and other reptiles do not expend energy to regulate body temperature, so they can survive for months without feeding.

Sexual maturity in alligators comes more as a function of size than age. Most alligators are capable of reproduction by the time they reach six or seven feet in length. A female may require ten to fifteen years and a male eight to twelve years to reach that length. That may seem like a long time, but alligators can live more than sixty years.

Courtship rituals begin in early spring, and mating occurs late May through early July. The females build large nesting mounds out of vegetation about three feet high and six feet wide on banks or in marshes, where they bury their eggs. As the nesting materials decompose, heat is produced to incubate the eggs at the proper temperature, and the raised mound helps protect them against flooding. The sexes of the embryos are determined by the temperature of the nest. Males are produced at intermediate temperatures (90.5–91.4 degrees F), while females are produced at low and high nest temperatures. Females deposit an average of thirty to forty-five eggs that incubate for sixty to sixty-five days and hatch in late August or early September.

Females stay near the nest during incubation to protect the eggs. Alligators are most territorial during mating and egg incubation and may be aggressive toward intruders. As soon as the eggs hatch, the female moves the young to the water, where she protects them for a year or more. The mortality rate for hatchlings is around 80 percent, with eggs and young susceptible to raccoons, feral hogs, bears, large fish, herons and other birds, and even adult male alligators.

Public Health Concerns

Alligators do not carry any known diseases that can affect humans. Since alligators are large and sometimes dangerous, their attacks can be a human safety concern.

Problems

As demand for housing continues to grow, more and more wetland habitat is swallowed up. Draining wetlands for development displaces alligators and other species. The more human beings move into their territory, the greater the number of human-alligator conflicts. Most complaints involve alligators in such places as garages, backyard pools, and water hazards on golf courses. Alligator attacks on humans are actually quite rare. Attacks on dogs are more common, probably because dogs are closer in size to an alligator's natural prey.

Solutions

Tolerance

Alligators may wander somewhat, but they never stray far from fresh water. An alligator in a yard or other inappropriate place will likely leave of his own accord if left alone. One of the most important things a homeowner can do in these situations is to make sure that all pets are inside and that people, especially children, do not gather around an alligator. Give him a chance to move away under his own power and be prepared to call the authorities if he does not seem willing to do so.

Exclusion

A solid fence at least five feet high should exclude alligators, although these animals have occasionally been observed climbing fences to approach dogs or livestock. Consult with local experts to ensure that any fence is designed to keep alligators out.

Minimizing Contact

The best action you can take to protect yourself as well as the alligators is to refrain from feeding them. Most attacks on humans are from alligators who have been fed and have lost their natural wariness of people as a result. Do not feed them unintentionally by leaving food, trash, or fish scraps on shore. Swim only by day and in designated swimming areas in alligator country. Since alligators are more likely to feed at dawn, dusk, and nighttime, minimize your outdoor activities, and your pets', during those times.

Avoid antagonizing an alligator. Throwing things at or even approaching an alligator is inappropriate and dangerous behavior that could provoke this powerful, surprisingly swift, and potentially dangerous animal. Since alligators prefer easy prey, if you are attacked, the best response is to fight. Usually an alligator will release prey that is too large and not easily overpowered.

Trapping

Alligators are fairly easily caught or trapped, but this potentially hazardous job should be left to professionals. Contact your local fish and game department for assistance. Translocation of trapped alligators is generally not successful, as they tend to return to their home range. Regrettably most problem-causing alligators are killed, so it is best to intervene early in potential human-alligator conflict situations, before the animal has to be removed.

Alligators as Pets

Alligators, crocodiles, and caimans (South and Central America crocodilians) should never be kept as pets. Do not remove any alligator from his native habitat, as he will not become "tame" and will not make a safe pet.

A Last Word

Alligators and human beings coexisted peacefully in the southeastern United States for a long time. It is only in the last fifty years or so, as people have moved farther into their native habitat (while paradoxically creating more habitat with artificial lakes), that conflicts have increased. These awe-inspiring reptiles are an important part of their ecosystem. Other species use alligator nests to incubate their own eggs and shelter in gator holes. Alligator nesting activity helps create nutrient-rich soil and, through predation, alligators control the numbers of many species. Improved education, tolerance, and respect are the keys to preserving alligators and reducing the number of conflicts.

Resources

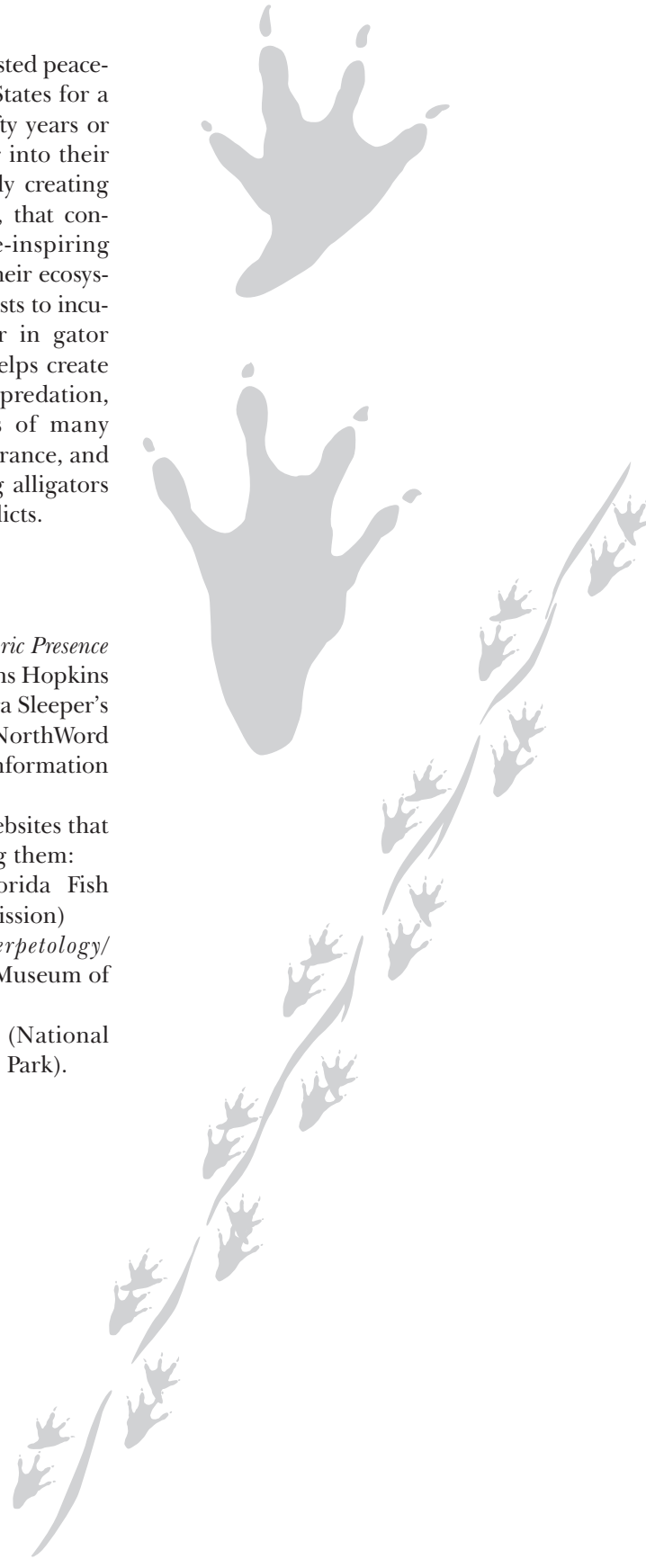
Barbara Strawn's *Alligators, Prehistoric Presence on the American Landscape* (The Johns Hopkins University Press, 1997) and Barbara Sleeper's *Alligators: Beneath the Blackwater* (NorthWord Press, 1996) are good sources of information on these animals.

There are also a number of websites that contain good information. Among them:

www.wildflorida.org/gators (Florida Fish and Wildlife Conservation Commission)

www.flmnh.ufl.edu//natsci/herpetology/brittoncrocs/csp_amis.htm (Florida Museum of Natural History)

www.nps.gov/ever/eco/gator.htm (National Park Service, Everglades National Park).



10

Armadillos

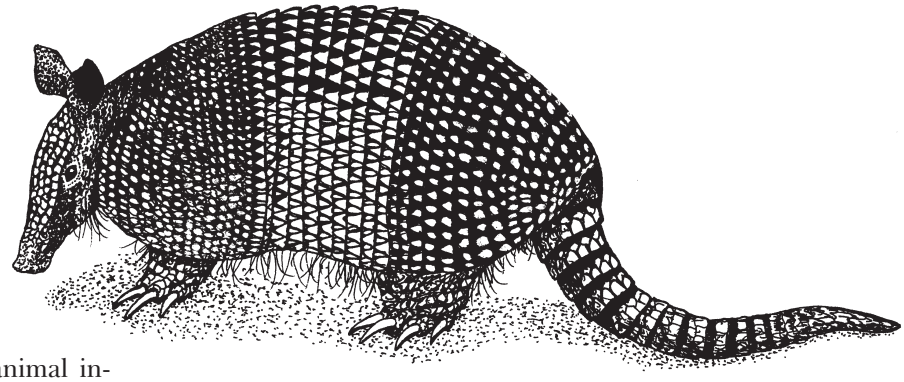


Figure 21 *Armadillo*

A VERY LONG time ago, the North and South American continents were separated by a sea that isolated their animal inhabitants, sending them along divergent evolutionary paths. When the continents joined, many predators from the north swept down into the south, and many fascinating and unusual South American life-forms disappeared. Four mammals that managed to survive and move north are animals familiar to us today—sloths, anteaters, armadillos, and the Virginia opossum; the last is the only marsupial that migrated north. Only the armadillo (from the Spanish meaning "little armored one") and the opossum remain in the United States (Figure 21).

Although armadillos have several distinctive and unusual characteristics, the more than two thousand bony scales that cover the head, legs, and back are their most notable feature. Making armadillos unique among mammals, this armored "shell" is composed of hard bony plates covered by a leathery skin. Even though these scales are described as "armor," they cannot really repel predator attacks. They may, however, provide protection when

- **An armadillo's armor protects not only against the claws and teeth of predators but also against the sharp twigs and thorns that are plentiful in brushy habitat.**
- **During hot weather, armadillos are mostly nocturnal; in cooler weather, they switch to being active by day.**
- **This is not a myth: armadillos walk along the bottom to cross shallow streams or rivers.**

the armadillo coils herself in her burrow and a predator cannot get enough of a grasp on her body to do any damage.

The armadillo has adapted very well to the southern United States and is still expanding its range. People aided this range expansion as they transported armadillos from one part of the country to another, for whatever reason. The full biological and ecological impact of human-aided movements of different animal species from one place to another has never been estimated, but it is certainly much greater than commonly recognized. When a species moves into new habitat, there is usually a period of adjustment, during which there may be more problems than there are later. Control programs launched during these adjustment periods may make no difference at all, although the subsequent natural stabilization of populations may make it appear they do.

Classification and Range

The armadillo (*Dasypus novemcinctus*) found in the United States is called the "nine-banded" armadillo because of the nine bands that run across the armor plating on the back that allow it to flex. Although there are more than twenty species of armadillo in the western hemisphere, only one, the nine-banded armadillo, ranges as far north as the United States. (The number of bands actually varies somewhat, but this does not change the taxonomic status of the animals found throughout much of the south-central and southeastern parts of the country.) One population of these animals in Florida started with the escape of a pair from a zoo in 1922. Moving westward, they eventually met up with armadillos who already had been moving eastward from Texas for many generations. Today armadillos are found as far north as Oklahoma and Arkansas. All armadillo colonization of North America apparently has taken place within the last 150 years.

Habits

Armadillos live in a variety of habitats, including thorn scrub, mixed grasslands, and wooded bottomlands. Their preferred habitat may be wetlands with dense shade and sandy soils that are easy to dig. Armadillos dig numerous emergency and temporary burrows, which range in depth from twenty inches to twenty feet. Most have a single entrance with a southern exposure. Other more permanent abodes may include a network of tunnels with three to four entrances. Birthing chambers tend to be located at least three to five feet below the surface and at sharp angles to a main tunnel. The chamber is usually lined with leaves and grass.

Nearly all of the armadillo's diet consists of insects and other invertebrates, taken during usually nocturnal forays. Armadillos may also forage on certain plant foods, especially berries, and small animals, eggs, and carrion, as opportunity allows.

Armadillos reach maturity at about nine months of age. They mate between July and August, but implantation of the developing embryo is delayed until November. Under some conditions it is thought that impregnated armadillo females may delay implantation for as long as two years. Once implantation has occurred, gestation takes about 120 days. Each litter typically consists of genetically identical quadruplets, all derived from a single egg. Newborns are born fully developed, but it takes several weeks for the pink leathery skin to harden into its lifelong protective covering.

The armadillo is generally a solitary forager, although animals may share their den with other armadillos of the same sex. Armadillos are almost constantly active when foraging—poking and probing into crevices and under litter for the insects and small animals that make up their diet. They grunt continuously while foraging and appear not to be particularly attentive to their surroundings. In fact, a foraging armadillo may actually bump into a person who is standing still before recognizing that anyone is there.

Armadillos have few natural enemies other than people, dogs, and some larger predators, such as coyotes and bobcats. Vehicle collisions and weather may be the biggest factors controlling their populations.

Public Health Concerns

Armadillos can be infected with the bacterium that causes human leprosy, and this disease often proves deadly within months, as infected armadillos exhibit much different and more severe symptoms than humans. A few cases of human leprosy in Louisiana and Texas have been anecdotally attributed to close contact with and consumption of armadillos and their meat, but this connection remains unproven.

Problems

Two types of problems with armadillos generally occur. The first is during opportunistic feeding activities when a passing armadillo roots around in a landscaped area or garden and disturbs plantings. The second type is digging semipermanent tunnel networks or birthing tunnels in places people find inconvenient.

Solutions

Tolerance

The disturbance of vegetable or flower gardens is generally temporary. It may not require any eviction measures, because the armadillo may simply move on after exploiting a locally abundant food source. In some cases, the armadillo may even provide a free service by feeding on destructive insects. Armadillos are one of the few animals that will take on fire ants and can be highly beneficial where these insects are present. The effects of armadillo tunneling and burrowing are also usually localized. These should be addressed by a combination of habitat modification, exclusion, elimination of cover, and acceptance of these animals' temporary or limited presence.

Habitat Modification

Backyard habitats where armadillos cause problems can be managed to control access to food, water, or shelter. Removing brush or weed cover can eliminate shelter and encourage armadillos to move elsewhere. Armadillos will often forage for invertebrates in leaf litter, and removing this ground cover might help cause them to move on. Controlling insects or other food sources may help, and, if it can be accomplished humanely, restricting access to sources of water can deter armadillos.

Exclusion

Fencing can effectively exclude armadillos from gardens, small yards, or water sources. Armadillos are able climbers, and fences should be designed to prevent "climb-over." This can be accomplished by providing a rigid overhang that extends outward for a foot or more at a 45-degree angle, or by not securing the upper twelve to eighteen inches of the fence so that it "flops" and does not provide enough purchase for the animal to surmount. Installing a "roller" along the fence top also offers effective protection. Any fence intended to deter armadillos must take into account their digging skills and be fastened securely to the ground or, better still, buried a foot or more to deter tunneling. Any of these alternatives involves considerable effort and expense, and it may be easier to live with armadillos than to invest in such efforts.

One-way doors may prove useful in getting armadillos out of burrows and not allowing them back in. The digging abilities of these animals are formidable, however, and attempts to exclude them from burrows must be persistent.

Live-Trapping

Some homeowners insist on live-trapping and relocating problem armadillos, although we would argue that this approach is of limited practical value. It should never be done during the birth and rearing season (March–September), as this could result in a fatal separation of dependent young from their mother.

A Last Word

Are armadillos pests? They are for those homeowners who feel their yards and gardens must be kept and managed to strict standards. We always hope such people will understand that the great outdoors is not an extension of their living quarters, where they can arrange things precisely the way they want them. The outdoors is "messier," and it doesn't do human beings—or the animals who live there—much good to seek to control its appearance the way we do indoors.

Additional Resources

Larry Smith and Robin Doughty's *The Amazing Armadillo* (University of Texas Press, 1984) is an interesting and readable account of these animals.

More information about them can be found at the University of Michigan's Museum of Zoology Animal Diversity website:

http://animaldiversity.umz.umich.edu/site/index.html.

11

Bats

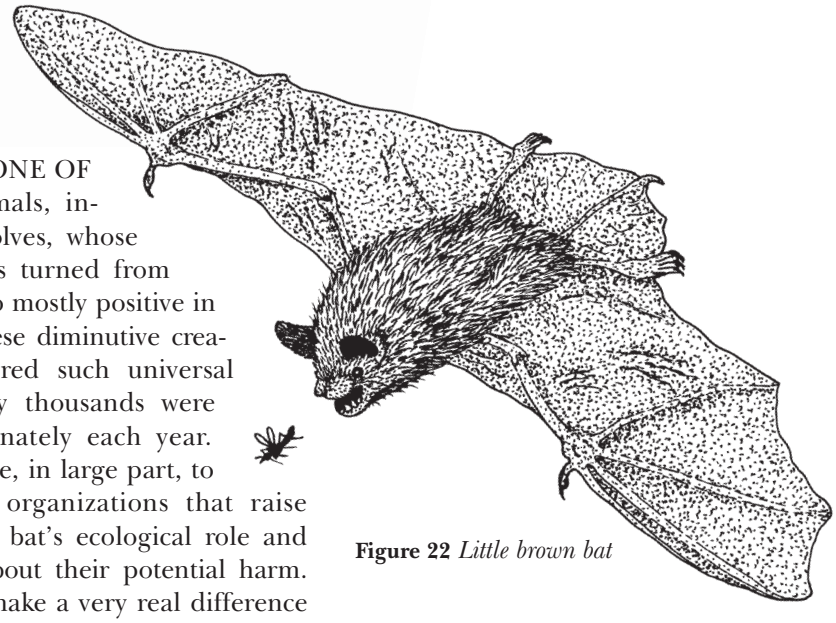


Figure 22 *Little brown bat*

Bats are one of a few animals, including wolves, whose public image has turned from highly negative to mostly positive in recent times. These diminutive creatures once inspired such universal dread that many thousands were killed indiscriminately each year. The change is due, in large part, to individuals and organizations that raise awareness of the bat's ecological role and counter myths about their potential harm. Individuals can make a very real difference for animal welfare. Thanks to those who champion bats, we now know they rarely cause problems for humans and frequently are valuable in controlling insects regarded as pests.

- **The little brown bat can consume up to sixty mosquitoes in an hour as it zips through the night air to feed.**
- **In flight, little brown bats use their echolocation capabilities to detect and avoid objects as thin as a hair.**
- **A fat bat? Like chipmunks and woodchucks, bats store fat in preparation for their hibernation.**

Classification and Range

All bats belong to the order *Chiroptera*, the only group of mammals that is truly capable of flight. There are 17 families of bats that contain 925 species worldwide, with 45 species occurring in four families found throughout North America. Most people are not able to distinguish one species of bat from another in the air. However, a bat is not just a

bat. Some are solitary, some live in groups. Some roost in houses at times, others never will. Only a few species ever come into conflict with humans at all. These may include the wide-ranging little brown bat and related western species (*Myotis spp*.), the big brown bat (*Eptesicus fuscus*), the evening bat (*Nycticeius humeralis*), the pallid bat (*Antrozous pallidus*), the big-eared bat (*Corynorhinus spp*.), the free-tailed bat (*Tadarida brasiliensis*), the mastiff bat (*Eumops and Molossus spp*.), and the pipistrelle (*Pipistrellus spp*.).

Many other species may occur locally. Local libraries often offer mammal field guides and other publications that show the amazing diversity and variety of this group of animals. National and local bat conservation organizations are also excellent sources of information.

Habits

All North American bats are nocturnal, although they may be quite visible at dusk when they begin foraging. Bat species tend to have specific habitat requirements for their daytime refuges. For example, big brown bats prefer that nursery colony temperatures not exceed 90 degrees Fahrenheit (F), while little brown bats prefer temperatures in the 90–110 degree F range, and some other bats tolerate temperatures up to 120 degrees F.

Bats in temperate areas migrate or hibernate, while tropical bats, sometimes of the same species as temperate migrants, may remain active in the same area all year. Most migrants travel only a few hundred miles, but a few species migrate longer distances. Both the summer colonial and solitary species collect in groups, often in caves, mines, buildings, or other hibernation sites (called hibernacula), and spend the winter in a state of torpor. Hibernating bats may wake periodically throughout the winter, but being fully aroused can be dangerous to them, as it can use up a very large proportion of their stored energy. For that reason, human disturbance of hibernating bats must be minimized or avoided altogether.

Nearly all North American bats feed on insects, which they usually catch in flight. They detect their prey by echolocation, which is the remarkable ability to emit high-frequency sounds (outside of human hearing) to discern objects by the sound reflected back to the bat, much like sonar on a ship. This sense is so acute that some species can detect objects in flight no wider than a human hair. Different species specialize in eating different insects, but as a group, all bats are regarded as beneficial because of the many insects they consume.

Depending on latitude and local climate, most species give birth to a single young (or occasionally twins) in late spring, usually beginning in early May, although late April births do occur. The young of some species are able to fly after only three weeks or a month. Most young begin foraging with their mothers sometime in July, but they may not be independent until the end of the summer. The newborn of some species cling to the mother while she hunts, but all offspring are left behind as they grow too large to be carried. Bats often use attics as nurseries, because they

Bats and Bedrooms

The National Centers for Disease Control and Prevention (CDC) recommends people capture, if possible, any bat discovered in a room in which a person was sleeping. The bat should then be submitted to local or state health authorities for rabies testing, which means she will be killed. CDC recommends this precaution because, in a handful of rabies cases from bat-associated strains, the patient did not report an animal bite, leading to the suspicion that adults may overlook, or children may underreport, bat bites. As we advise with any situation involving potential exposure to rabies, consult your physician and local health authorities immediately.

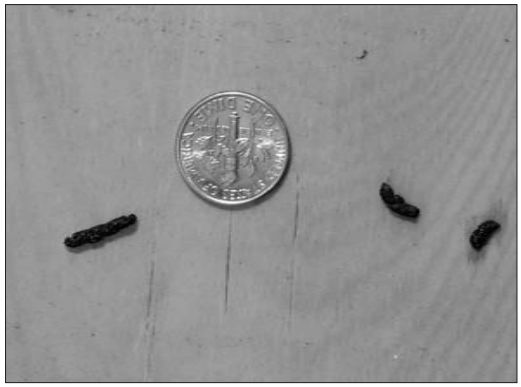

THE HSUS

Figure 23 *Bat droppings are tiny, hard, and appear shiny most of the time due to the insect diet on which bats live.*

maintain desired temperatures for raising young. Nursery colonies only contain breeding females and their young; the adult males and nonbreeding females roost elsewhere.

Public Health Concerns

Two infrequently encountered species, the silver-haired bat (*Lasionycteris noctivagans*) and eastern pipistrelle (*Pipistrellus subflavus*), are associated with a strain of rabies that has caused human deaths. The incidence of this disease in bat populations is extremely low, however, and rabid bats generally do not become aggressive and do not bite without provocation, although any bat may bite in self-defense. Most of the extremely rare confirmed human rabies exposure from bats happened when people accidentally or carelessly handled bats—for example, picking up a bat with bare hands or taking a bat from a pet's mouth. If a bat must be handled for any reason, leather work gloves offer protection from their small teeth. Large accumulations of bat droppings may harbor histoplasmosis fungi spores, which can be a public health concern.

Problems

Bats rely on existing openings to enter buildings rather than making or enlarging entry holes. Small (half-inch or greater) openings or narrow (quarter-inch-wide) gaps high on houses, around chimneys, at the union of dormers with roofs, or at loose siding can all provide access. Bats may also enter under loose-fitting doors, around windows, and through gaps around conduits and utility vents. Bats roosting in houses can go unnoticed for years until accumulated feces and urine leach through attic spaces to stain the wall or ceiling on the living area below (Figure 23). Then homeowners often feel they have an immediate crisis, when, in fact, they have been living with the bats for years.

An individual bat may become an accidental intruder in a home, raising a different type of problem. Often the bat is first observed flying around a room early in the evening, landing on curtains or furniture and then taking flight again. In this case, getting the bat out of the house becomes a high priority.

Occasionally, a bat or a small group of bats hanging from a porch ceiling or under the eaves will surprise people coming home after dark. In such cases, the bats are simply resting between feeding flights and have probably chosen this location because it is close to their food—insects attracted by outdoor lights.

Solutions

Tolerance

Bat flying at dusk above the yard are absolutely no cause for alarm. This is perfectly natural—the bats are foraging for flying insects. Even encounters with bats temporarily trapped inside a house or discovered in an attic should not lead to hasty or panicked responses. Trapped bats can be removed and attic colonies excluded in a humane and effective manner that will minimize stress on both humans and bats.

Accidental Encounters

Any direct encounter with a bat inside or outside is accidental on the bat's part. These animals always try to avoid contact with humans and their pets if they can. The myth of bats

becoming entangled in one's hair is exactly that—a myth. Bats found outside may be ill, may be temporarily stunned from flying into a window, or, in colder weather, may simply be torpid and unable to move or fly as well as they can when warmed. Bats accidentally intruding in a home require essentially the same responses as bats outdoors, except that the bat needs help in getting out.

In any encounter with a bat, remain calm and keep pets and children away. For bats outdoors, this is usually the only action that is necessary. If the bat is inside, he will probably try to fly to an opening. Because of the confined space, however, he will have to fly in a U-shaped path, gaining altitude near the walls and losing altitude in the center of the room. A person standing in the middle of the room may feel attacked when the bat is only trying to stay airborne. Stay near a wall.

Close interior doors and give the bat an exit by opening an outside door or window. If the bat disappears before you provide an exit, he probably has landed somewhere he can hang—behind curtains or upholstered furniture, on hanging clothes or in house plants (Figure 24). Search and try to capture him in a net, such as a butterfly net, if one is available. If a net is not available and the bat is hanging on a vertical surface, carefully place a glass jar or plastic tub over him (metal cans can quickly cool bats to unsafe temperatures) and gently work a piece of cardboard or stiff paper between the container and the surface of the wall, trapping the bat inside.

A thick towel is a good way to capture a bat on the floor. Roll the bat up gently, take the towel outside away from bystanders and domestic animals, and unroll it. Leather (not cotton) work gloves are adequate protection from a bat's teeth and will allow a person to pick the animal up safely. *Never try to handle a bat with bare hands*. Be prepared for the bat to vocalize loudly in protest when picked up. Release the bat as soon as possible in a place where he will be out of harm's way if he does not fly immediately. Some bats can take off from the ground, but many can't, and allowing any released bat to climb a tree trunk or other vertical surface is a good idea.



Figure 24 *Little brown bat*

After freeing the bat, find out how he entered the house. If an open window or door can be ruled out, then the bat may have been roosting somewhere within the outer walls of the house and accidentally found a route into the living space. Common entry points include gaps around window air conditioners, chimneys, and openings in interior walls that lead to attics or cellars that may harbor more bats. Inspect thoroughly and seal potential interior entrances.

Exclusion

In houses bats are most likely to colonize attics. The key to excluding a bat colony is to find all openings the bats are using. Sometimes, a well-used opening is discolored on the outside from the body oils that rub off as the bats come and go. Because discoloration is not always observed, a "bat watch" at dusk can reveal entrances. Watch closely from before sunset until at least thirty minutes after; it only takes a second or so for a bat to exit and take flight.

The best strategy for excluding a bat colony from a building is to allow the bats to leave on their own and then to deny them

reentry. Evict bats only when no dependent young are present. From late April through August is *not* a good time to try to solve bat colony problems, and many states now have laws specifically prohibiting exclusion at these times. After bats leave for the winter hibernacula, exclusion can be done in a more careful and deliberate manner, but be aware that some bats (such as the big brown bat) may overwinter in human structures and exclusion would trap them inside. In this case, the recommended approach is to use the check valve system described below after deciduous plants leaf out and when insects become abundant, but before births occur.

If you must exclude a bat colony, locate and note all outside entrances during bat watches. Do not simply seal up all openings at night. Not all the bats leave at the same time, nor do all leave every night, and you will likely trap some inside. Install one-way bat check valves on all entrances you find. If you are certain that all areas the bats are using are connected, you can seal some entrances and install check valves on the main one or few (Figure 25).

There are two main types of check valves for excluding bats. The Hanks excluder mounts over an exit hole and funnels bats out of the structure but does not allow them back in. The check valve system designed by Steve Frantz, of the New York State Department of Health, uses netting to exclude bats from reentry. Netting is draped over the opening bats are using to gain entry to a building, forcing them to move down the wall of the structure before they can fly free of it. Lightweight, flexible netting with 1/6-inch or smaller mesh is attached, usually with staples, to the structure, with the bottom open for exit and extending at least one to two feet below the entrance. Because bats use tactile (airflow) cues and possibly smell to locate exit/entry holes on return, these systems prevent them from regaining access. Left in place for at least five to seven days, these devices give all bats a chance to leave.

For buildings with rough exterior walls (such as brick or stone) and for holes at corners and in horizontal surfaces, the Hanks excluder works well. Tubes with lightweight plastic sleeves that collapse prevent bats from returning once they crawl out. To make one of these devices, tape lightweight plastic securely around the end of a PVC pipe or flexible plastic tubing that is two inches in diameter and about a foot long. The pipe or tubing end of the check valve can be squeezed into narrow crevices or cut into flaps that can be opened up and attached securely to the structure with staples, nails, or strong tape.

After excluding, you should check the attic carefully to be sure there are no bats left and watch the outside of the house in the evening again to make sure the bats have not found another way in. If they have, add a check valve to the new entrance. After you are sure the bats are gone, remove the check valves and seal the entrances with appropriate building materials (hardware cloth, netting, or sheet metal).

Bat Houses

For bat conservation, and because it is something of a fad, many people put up bat houses in their yards. Bat house design, placement, and other factors strongly influence whether bats use a house. In recent surveys that included all types of house design and placement, bats used about 60 percent of bat

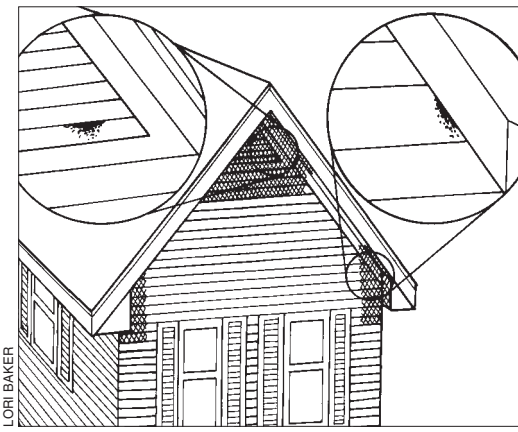


Figure 25 *Bat check valves can be installed at appropriate times of the year over the entry/exit holes bats use to enter and leave buildings. The bats drop down and leave, but on returning cannot regain access.*

houses. Bats are more likely to use houses installed in groups and on buildings or poles rather than those on trees. Where you mount a bat house strongly influences the temperature inside the houses and, therefore, use by bats. If you must exclude bats from a building, consider putting up well-designed and appropriately mounted bat houses first. One small sample of bat houses installed when bats were excluded from buildings found that displaced bats inhabited more than 90 percent of them. Prefabricated bat houses, as well as simple plans for building them yourself, are available at many nature centers and retail outlets specializing in bird feeding and wildlife products, as well as from Bat Conservation International (BCI).

A Last Word

Dozens of other species of wildlife need to join the bat and the wolf as deserving of public respect and understanding. Taken one species at a time, it might be some while before the value of all of them is recognized, but by using an ecosystem approach, we may make more rapid progress toward accepting the positive value of all wild animals.

Resources

Merlin Tuttle's *America's Neighborhood Bats* (University of Texas, 2005) is a go-to resource for information and advice. The group Tuttle founded, BCI, is an excellent source of advice and information on everything from natural history to conflict resolution for bats. It is on the Web at *www.batcon.org* or reachable by phone at 512-327-9721.

12

Beaver



Figure 26 *Beaver*

LIKE ITS EUROpean counterpart, the North American beaver was once nearly driven to extinction by the demand for its fur: the thick, dense under hairs of the beaver pelt could be processed into a fine waterproof felt that made superior hats (Figure 26). So many beaver were killed in the year 1700 that 200,000 pelts were removed from a warehouse in Montreal and burned to keep them from driving prices down on the European market. Where beaver had been trapped and killed, they left behind the wetlands they had created as rich, treeless plots for growing crops in the New World. No one will ever know exactly how much help beaver provided to the European colonization of North America, but all indications are that it was considerable.

Beaver are now making a comeback. Their return is leading to growing conflicts with human beings, usually over who gets to occupy floodplains. People are only beginning to recognize that, while it is reasonable and environmentally appropriate for the beaver to build and live in these areas, it is far less so for humans. One of the great chal-

- **Beaver create wetlands, key habitats for many other species of animals.**
- **Beyond habitat, wetlands also provide environmental services such as filtering environmental contaminants out of the water before it enters rivers and estuaries.**
- **Beaver are able to submerge in water for periods of up to fifteen minutes, using special adaptations, such as skin flaps that seal their mouths, to stay submerged.**

lenges facing us as we seek to harmonize our relationships with the natural world is to recognize the environmental benefits we can derive from working with, rather than against, animals such as the beaver.

Classification and Range

The beaver (*Castor canadensis*) is the largest rodent found in North America. It has a very close relative in the Old World (*Castor fiber*) that some taxonomists regard as essentially the same species. But the European beaver has twenty chromosome pairs, while North America's has but sixteen, making that assumption unlikely. In many parts of Europe, efforts are underway to repatriate *C. fiber*, which is often found now side by side with the *C. canadensis* populations, arising from imports released some time ago. The challenges this presents are daunting enough, but they are only the beginning of what will be a highly interesting experiment: how densely settled human populations, in landscapes they have dominated for thousands rather than just hundreds of years, can coexist with repatriated wildlife.

Habits

The North American beaver can weigh more than sixty pounds, but an average adult is more likely to weigh about thirty five to forty. Including the trademark flat tail used as a rudder, construction tool, and communication device, adults are about thirty inches long and a foot high. When standing on his hind legs, however, an adult beaver can reach almost three feet in height. Where the winter snows accumulate, beaver can sometimes gnaw high enough on trees to conjure up tall tales about the possible return of the bear-size Pleistocene form of these animals.

Beaver live in and around water and constantly modify streams by building dams and impounding water to create ponds, although they will also live by large rivers and lakes without building dams at all. Early naturalists such as Lewis Henry Morgan and Enos Mills were keen observers of beaver and their works. We have their descriptions of the landscapes these animals occupied to give us an inkling of what once was. Morgan visited beaver impoundments just south of Lake Superior that had probably been in place for hundreds, if not thousands, of years. The dam at Grass Lake that he describes was 260 feet long, over 6 feet tall, and had obviously been the work of generations of beaver. Still, it would be dwarfed by the dam Mills measured at an astounding 2,160 feet long near what is now Rocky Mountain National Park in Colorado.

The beaver impoundment, or flowage, as Skip Lisle prefers to call it, provides a rich environment for many animal and plant species. The beaver dam is not like our more impervious structures of the same name. It holds back water to be sure, but it also leaks and allows water to move through the impounded system slowly—a system that may provide many benefits to the environment (Figure 27).

Beaver are herbivores, or plant eaters, feeding on the inner layer of the bark of woody plants (the cambium), leaves, shoots, and aquatic herbs such as duckweed, water lilies, and pondweed. Occasionally the fruits of terrestrial plants, some herbaceous forest plants, and even crops such as soybeans and corn may be eaten. The favored woody

Beaver Devices

The design and installation of beaver devices is often sufficiently complex that technical assistance from experienced professionals is recommended. Experience in reading sites and predicting how beaver will respond to attempts to defeat their dam behavior can be invaluable. It is also necessary to be aware of local, state, and federal regulations when planning to install these devices.



Figure 27
The beaver dam not only backs water up to help create and maintain wetlands, it also allows the water to leak slowly through, prompting the term "flowage" for this type of system. THE HSUS

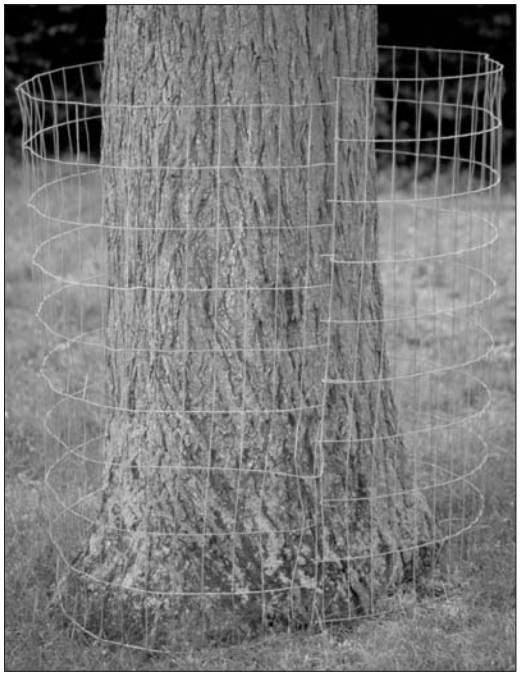
species may vary from area to area, depending on what is locally available, but where they are found, aspen, birch, willow, cottonwood, poplar, maple, apple, and even oak are preferred. A beaver's preferred food trees may also include popular ornamentals such as dogwood, hybrid poplar, and fruit trees. Their taste for cherry trees is evident every few years when they establish a presence, albeit temporary, on Washington, D.C.'s, historic Tidal Basin. Evergreen trees are rarely eaten, and signs of beaver working trees such as pine may be an indication that more suitable food is lacking. In the fall beaver may sink large accumulations of branches into the mud close by the lodge, to serve as winter food caches.

Most of the trees used for food or for other construction activities are felled within a hundred feet of the main body of water the beaver are using. Activity up to six hundred feet from water can occur, but probably only where colonies are urgently pressed to search for food. All told, beaver only occupy and influence a fraction of the landscape (some say as little as 3 percent). Beaver can cut down fairly large trees but seem to prefer those two to six inches in diameter. Often they partially or completely "girdle" trees, removing the bark but leaving the trees standing.

Many wetland plants and beaver have a long history of co-evolution. Some—such as aspen and willow, because they resprout when cut—may thrive in the presence of these animals, not as trees, but as shrubby riparian growth. Others may adapt physiologically to the presence of beaver by producing toxic compounds that make them less palatable to beaver.

Beaver produce one litter, typically of three or four kits, per year, usually between March and June. A beaver colony commonly contains six to eight animals, including an adult pair, one or two two-year-olds, and the kits from the last litter. Some parental duties are shared by the female and male and, in part, by the preceding year's young, who remain with the family as adolescents. Intense trapping and removal appears to stimulate the production of more young than when the animals are not trapped. Beaver become sexually mature and usually leave the area of birth by their second birthday, in a process referred to as dispersion. Dispersing beaver usually travel less than 6 miles in search of new homes, but movements of up to 150 miles have been documented.

Beaver build dams, lodges, canals, and scent mounds, all of which have an obvious presence, as well as an impact on the landscape. Canals occur in many beaver habitats where colonies have been established for some time and beaver need to move farther abroad to obtain needed food and building supplies. Dams and lodges, the woody structures built from branches, mud, and other debris, are most obviously associated with these animals, but living quarters can also be



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Figure 28 *Simple wire cages will protect trees from beaver damage. Large-scale installation projects along ponds and reservoirs are perfect for Boy or Girl Scout groups.*



THE HSUS

Figure 29 *A small beaver "deceiver" built by Skip Lisle to protect a roadside culvert. Lasting upward of fifteen to twenty years, these devices are practical and economical, not to mention humane.*

less obvious dens dug into the banks of streams or lakes. Bank dens can also take on the appearance of lodges as woody material is mounded over their openings. Both dams and lodges are packed solid with mud to make them strong and to help with insulation. Residences have at least two openings.

The late animal behaviorist Donald Griffith filmed the insides of beaver lodges with a specially built camera probe and found them to be teeming with all sorts of life, micro-ecosystems in their own right.

Public Health Concerns

It has long been suggested that beaver may be responsible for outbreaks of the parasitic disease giardiasis in humans. However, recent studies and examination of past outbreaks suggest that other factors, such as contamination of drinking sources with human waste, may play a larger role in the spread of the disease than beaver do.

Problems

The two most common problems associated with beaver are the flooding that results from impoundment or blockage of vulnerable structures, such as culverts, and the damage done to trees. Flooding can become a crisis if unusually heavy rains or snows cause sudden local inundation. On the other hand, dams can store water during periods of drought and slow down the movement of water from land to river systems that is often responsible for serious floods and significant financial damage downstream. Damage to trees in urban and suburban areas is likely to be noticed before it becomes critical but perhaps not before a valuable tree or two has been lost. Operators of commercial forests, especially in the southeast, attribute millions of dollars of timber loss annually to beaver.

Solutions

Tolerance

We've mentioned before the important role beaver can play in establishing and maintaining wetlands. Recognizing this is often a key to convincing people they should tolerate and try to live with these animals. Beaver impoundments provide habitat for many sensitive plant and animal species, improve water

quality, and provide flood control by slowing water movement. To these can be added the considerable aesthetic and recreational benefits people derive from beaver and the habitat they create. Public education can thus be an important key to ensure better recognition of the benefits beaver can bring.

Tree Protection

Simple, homemade tree guards using galvanized welded wire (two-inch by two-inch), placed out from the trunk and standing about three feet high, can be used to cage trees and prevent beaver damage. These can be especially effective where small (two- to six-inch-in-diameter) ornamental or specimen trees need to be protected. Cylinders around larger trees may require staking, and mulching within the cylinders is a good idea to keep weeds from becoming a problem. Chicken wire is generally too flimsy to provide good protection, and finer-mesh hardware, such as that used for window screens, is more expensive and need not be used unless welded wire is unavailable (Figure 28).

Experimental work by the U.S. Department of Agriculture has shown some success in protecting trees by using a mixture of coarse mason's sand (30–70 mil) and exterior latex paint. The ratio is twenty ounces of sand to one gallon of paint. The abrasive quality of the mixture is said to deter beaver, and the paint color can be matched to the tree so it will blend in with the environment.

Fencing can also be effective in blocking beaver's access to larger groves or trees in areas where they are not wanted. Beaver are not good climbers, and a three- to four-foot-high fence can be a permanent deterrent. Fences should be monitored frequently to make sure that beaver have not pushed under them, especially where the structures cross established beaver trails. An electrified wire strung approximately four inches off the ground can also prevent beaver from entering an area. This type of fence can be especially effective in a small garden or crop plot when set up to protect plants for a few weeks and taken down afterward.

Flood Protection

Beaver are superb engineers but still no match for human engineering. No matter what problems beaver cause, humans can trump them with solutions of their own. In the past, "solutions" to the building of dams by beaver have often involved the use of heavy machinery to tear the dams apart or sometimes even explosives to blow them up. Neither of these approaches is particularly enlightened, given that beaver will quickly attempt to rebuild their structures and will use new material to do so, exacerbating any perceived or real damage they may have done. Removing resident beaver through trapping or shooting only creates a vacuum into which new animals will move, often sooner rather than later. And all of the strategies aimed at removal or destruction deny the presence of beaver wetlands—landscapes that, we argue, are both appropriate and needed.

In the past decade, a rapid growth of new technologies that involve simple yet elegantly designed structures has promised prevention or control of flooding caused by beaver dams. Venerable devices such as the "Clemson leveler" have been used for more than thirty years. Newer concepts include the Beaver Deceivers™, Round Fence™, and Castor Master™ devices developed by Skip Lisle, as well as CulverClear™ technologies developed by Mike Callahan of Southampton, Massachusetts. Lisle's formula for success produces devices that are simple but rugged enough to withstand the force of ice (Figure 29). Whether these devices are constructed with wood or steel frames, the overall savings they represent, when compared to the costs of repeated beaver removal or dam destruction, make them highly cost effective as well as humane.

As with any good nonlethal approach, experts use various devices to take advantage of the behavioral predispositions of the beaver themselves. Beaver are thought to be motivated to build and repair dams using cues from the sound and perhaps the feel of flowing water. This is a logical response, since a draining pond could quickly expose a

colony to predators. Notching an existing dam and running a pipe through the breach will stimulate the beaver to repair the dam at the site of the notch but not at the pipe ends, thus allowing the water to be set at a level where it meets human needs. To ensure the upstream end of the system is not blocked by beaver or accumulating debris, a filtering device, called a Round Fence, can be installed. Rigid PVC pipes, used often in the past, are replaced now almost entirely with flexible corrugated plastic pipe, sized to the particular job, but usually somewhere between eight and fifteen inches in diameter.

Culvert pipes running under roads are often plugged by beaver, and where new roads are to be built or old ones retrofitted, proper culvert design should never allow this to happen. At existing culverts, the Beaver Deceiver is used, sometimes in conjunction with Round Fence and a pipe system at its front, and often as a stand-alone device. This approach involves creating a fence barrier in front of the culvert (usually shaped like a trapezoid but adaptable to different configurations as well) that takes the beaver so far away from the stimulus of running water that their instinctive motivation to dam seems to be defeated.

A Last Word

When the first European settlers arrived, it is estimated that the beaver population of North America numbered between 60 and 400 million individuals. Today, the United States has 6–12 million beaver, back from nearly complete extirpation. Americans are only slowly coming to realize that this return can provide significant benefits to a continent that has lost much of its former nontidal wetlands to development or agricultural conversion. The good news, if there is any, is that society has ceased the wholesale slaughter and wanton destruction of these animals to appease fashion trends. Other species are still at risk, however, for this and similar vanities, and we can only hope that the wholesale slaughter of any animal for its fur will stop soon as well.

Additional Resources

A book that is a must for anyone who is interested in the natural history of these animals is Dietland Muller-Schwarze and Lixing Sun's *The Beaver: Natural History of a Wetlands Engineer* (Cornell University Press, 2003).

A charming and enduring account of life in a beaver colony that is now a classic: Hope Ryden's *Lily Pond* (William Morrow, 1989).

Organizations and individuals to contact for information about beaver and assistance with beaver conflicts include:

Skip Lisle
Beaver Deceivers International
1187 Cabbel Road
Grafton, VT 05146
802-843-1017/*skiplisle@vermontel.net*

Mike Callahan
Beaver Solutions
14 Mountain Road
Southampton, MA 01073
413-527-6472; (fax) 413-527-6472
info@beaversolutions.com and
www.beaversolutions.com

Sharon and Joseph Brown
Beaver, Wetlands, and Wildlife
146 Van Dyke Road
Dolgeville, NY 13329
518-568-2077/(fax) 518-568-6046
BWW@BeaversWW.org
www.beaversww.org

Sherri Tippie
Wildlife 2000
P.O. Box 6428
Denver, CO 80206
303-935-4995

Skip Hilliker
The Humane Society of the United States
P.O. Box 3665, Amity Station
New Haven CT 06525
203-389-4411.

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Black Bears

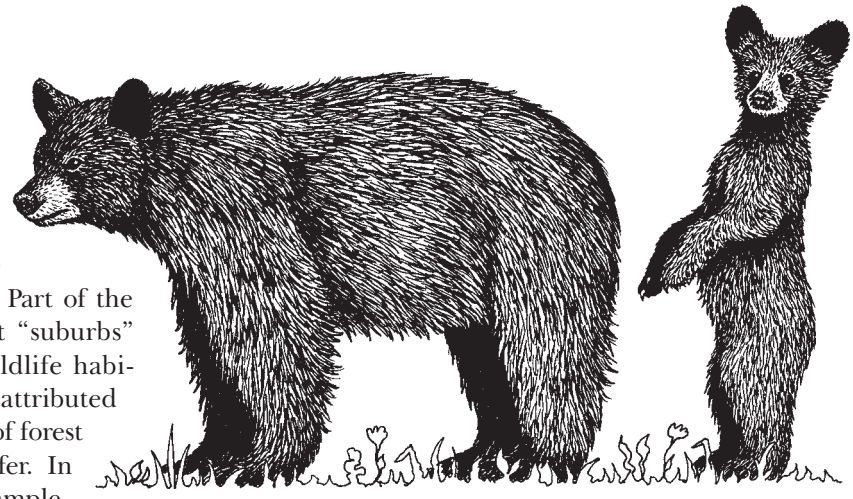


Figure 30 *Black bear sow and cub*

In many parts of the country bear sightings are increasing (Figure 30). Part of the reason for this is that "suburbs" are encroaching on wildlife habitat, but part must be attributed as well to the recovery of forest habitat that bears prefer. In New England, for example, forests have been reestablished on nearly 70 percent of the land previously cleared and worked for agriculture. Along with this reforestation come bears.

Traditional conflicts between humans and bears involved bear raids on crops and beehives. Assaults on garbage cans, bird feeders, and barbecue grills can now be added to the list, as can occasional attempts to establish winter dens under porches and decks and occasional run-ins with domestic pets. Because bears are large and powerful animals, encounters with them must be taken seriously, although the frequency with which they happen is remarkably low. Yet it seems that every encounter with bears receives headline attention in the press, not only because such meetings are so rare but also because bears are one of the few animals capable of reminding

- **Black bears are the smallest of the three bear species native to the United States, although that might provide little comfort if you find yourself standing next to one in the grocery checkout line.**
- **A dog-like woof is sometimes all hikers hear as a bear they have startled takes off at full clip.**
- **Bears are not true hibernators. Although a black bear's heart rate drops to eight beats per minute during his winter lethargy, his temperature only drops a few degrees.**

human beings that they are not the only big, powerful mammal out there.

Classification and Range

The black bear (*Ursus americanus*) is the most widespread and smallest of the three bears found in North America, while the larger polar (*Thalarctos maritimus*) and brown (*U. arctos*) bears are found in fewer places on the continent. The grizzly is the best known of a group of closely related brown bears that are among the most formidable carnivores in the world. Black bears range throughout Canada, the eastern United States, and throughout the West, excluding most of the Great Plains and Great Basin areas. The range of black bears generally follows the range of the continent's older, more mature forests or recovering woodlands.

Habits

Black bears occupy a variety of habitats. In the East they favor deciduous woodlands; in the Southwest chaparral and scrub forests may be used. Bears require fairly large areas to sustain themselves and are generally intolerant of other bears (outside of the sow-cub relationship). These characteristics contribute to the low population densities typical of all bears. The movements of individuals within their range may vary considerably based on the availability of preferred foods.

Many people assume black bears are exclusively meat eaters while, in fact, plant foods make up the bulk of their diet. Ripening fruits, berries, and nuts are eaten heavily, but when these are not available, the average black bear may simply graze on leafy or herbaceous vegetation. The non-plant foods bears eat can vary from insects to occasional small live prey. Bears are opportunistic hunters and will also take deer fawns, but they usually are not able to catch more agile adults. They will also eat carrion.

Black bear cubs are born in late January or February and remain with the mother through the next winter, setting out on their own when they are about eighteen months old. Females do not breed again until the cubs are old enough to survive independently. Studies have shown that the reproductive rate of black bears is closely linked to food availability. In years when mast crops are small, females may mature more slowly, have fewer cubs, or forgo reproduction completely. Add the fact that females do not usually begin breeding until they are between three and five years of age, and it is clear that this animal's reproductive patterns keep its populations low.



THE HSUS

Figure 31 *Where dumpsters are unprotected in bear country, bears will be found.*

Denning, or winter lethargy, occurs during the winter. Even in the South most bears enter into a dormancy period, although it may not last as long or be as profound as the winter sleep of bears farther north. Rock ledges, brush piles, hollow trees, and occasionally spaces under decks and patios or in culvert pipes provide refuge from winter cold. Research has shown that bears will shorten the length of their dormancy period in areas where human refuse is reliably available.

Public Health Concerns

There are no significant diseases or parasites of bears that can be transmitted to humans.

Rabies does occur in these animals, but it is so rare that no confirmed exposures of humans have been recorded

Problems

Bears den occasionally under decks or porches, especially in summer houses or residences that are used only periodically. They raid gardens and get into trash with a facility that aptly demonstrates their size, power, and intelligence (Figure 31). Bird feeders, dirty grills, and pet food left outdoors are magnets to a hungry bear. Black bears also occasionally cause significant damage to beehives and field crops.

Solutions

Tolerance

As with all of the species discussed here, tolerance and understanding have a key role to play in how human beings approach conflicts with them, even (or maybe especially) with animals as large and formidable as black bears. Large animals tend to be potentially more dangerous to people than most small ones, but they also tend to be less common and require a larger living area, or home range, to sustain them. For a homeowner, an encounter with a bear might be a once-in-a-lifetime event. The animal in a backyard might be a youngster moving out of his mother's home range to look for a suitable home or an adult who has come by the house to investigate a smell or sound that attracted his attention. Once he has figured out that the attraction is related to humans, he is likely to head over the mountain and not be seen again. But if he obtains a meal without negative consequences, he is more likely to return for more. With each free meal, his fear of humans and their dwellings diminishes, until conflict with people is almost inevitable.

When conflicts occur, the bear is nearly always the loser. In many states so-called nuisance bears are killed or trapped and moved to remote areas some distance from the site of the conflict in the hope that they will not return. Some do not, but many do, and this practice is probably on its way out as aversive conditioning becomes more common. In most instances, the death of the bear could have been avoided had property owners not provided an easy meal and thus reduced the bear's natural fear of humans.

Exclusion

Electric fencing can be used to protect highly bear-attractive resources such as beehives and refuse sites. Additionally, these can be located away from areas frequently used by bears, such as berry patches, wildlife trails, and stream corridors. It is best not to place trash cans outside at night, but if it must be done, investing in a "bear-resistant" trash can or enclosure is the way to go.

It is important not to keep an open compost pile in bear country, especially one in which household refuse is dumped. Burying compost also is not advised, because bears can dig it up easily if motivated by enticing odors. Enclosed recycling bins are recommended if refuse must be stored outside; however, determined bears can break into even ruggedly built bins. Keep any grills located on decks or close to the house clean and as free of drippings as possible. It is preferable to move the grill well away from the house when it is not being used. Place birdfeeders well away from the house or forgo feeding birds in areas with known bear populations, since even this food can attract bears. Finally, as park and wildlife professionals increasingly urge, make sure when camping that food is secured at a recommended distance from the campsite.

Minimizing Contact

As is the case with other large and potentially dangerous mammals, there are rules of engagement with bears that can help to minimize the possibility of people putting themselves in danger. The rules described here for black bears are, we caution, different from those for dealing with brown or polar bears, which can be extremely dangerous in close

encounters. Black bears, on the other hand, are far more likely to withdraw than to confront humans, even when surprised. People are usually wary of black bears, and in thinking that they might be attacked or even eaten, sometimes react to encounters in ways that actually increase the likelihood of injury.

Never try to approach a black bear to drive him off, but do not allow him to feel comfortable in your backyard. Shouting, banging objects together, making as much noise as possible, and looking as big as possible (by spreading your arms, or better, a coat, outward) are all effective responses. Let the bear know you are a human. Never run. Throwing things at the bear is a proven way to get her to move off. In the rare instance in which a black bear bluff charges, experts advise standing still. The bear does this only as a warning and invariably turns and moves off after the display. After the bear leaves, remove any food sources that might have attracted her.

Errant Bears

Young bears dispersing from the area in which they were born and in search of a suitable home for themselves sometimes end up in suburbia without a good idea of how to get out. This frequently leads to a perceived crisis, in which the bear climbs a tree, a telephone pole, or anything she can reach to get away from people, who only gather in larger crowds as word spreads of the curiosity. Confusion and uncertainty, coupled with inexperience and a misconception of the threat such an animal poses, can often lead to fatal consequences for the bear.

This does not have to happen if a little foresight and planning are applied to make sure that qualified and properly equipped wildlife professionals or veterinary assistance can be called upon. Leaving the bear alone and giving her the opportunity to move off by herself is always the preferred solution. Tranquilization and removal of the trespassing bear can save a life, or it can take one, because this procedure always presents a high risk for the bear. In forced situations, however, such action may be the best solution to protect both humans and the bear.

Repellents

There are pepper (capsaicin) sprays marketed for repelling bears, and hikers in grizzly bear country are often advised to pack these in with them. Much tested in parks where panhandling bears are a problem, the spray has also been proven to work and to be effective at chasing bears from campgrounds. Some smarter bears, however, learn the effective range (usually about ten to twelve feet) and stand just beyond that when they encounter humans who might spray them.

Community Approaches

The key to avoiding conflicts with black bears is individual responsibility—managing your property so as not to attract bears—combined with community programs. One key to community action is to pass and enforce laws that require residents, businesses, and municipalities to use bear-resistant garbage containers and fine those who intentionally or unintentionally feed bears. Another is simply public education. Fliers and informational handouts (especially in communities with a lot of turnover from tourist visits) are critical to teaching people some of the rules about living with bears.

To supplement these measures, it has become increasingly common for communities to conduct programs to educate the bears as well. The classroom is the great outdoors, and the lessons are intended to reinforce the natural wariness of bears toward humans. When a resident in bear country is concerned about the behavior of an individual bear, the first call he often makes is to the local police. By providing law enforcement personnel with the knowledge and tools they need to condition a bear to avoid people, many conflicts can be eliminated.

This aversive conditioning approach focuses on providing extremely unpleasant experiences when a bear is engaging in the undesirable behavior. The tools include rubber bullets, pyrotechnics, and pepper spray,

applied in ways that demonstrate to the bear, an animal to whom dominance relationships are all important, that humans are unquestionably the top dogs (or, if you will, top bears). The goal is to modify undesirable bear behavior without destroying the bear, thus leaving an "educated" bear as a territory holder to help repel those who have not yet been converted.

A Last Word

It is entirely possible that human-bear encounters will become more frequent in the future. People are increasingly entering bear habitat, and bears are returning to places from which they were previously extirpated. As serious as encounters between people and bears may be, the solution to conflicts is not to manage bear populations through hunting or deliberate actions intended to lower population density, since problem bears are not necessarily the ones killed in recreational hunts. The solution lies in educating people on how to behave in bear country, and, when necessary, educating bears to avoid people.

Additional Resources

Linda Masterson's *Living With Bears: A Practical Guide to Bear Country* (PixyJack Press, 2006) contains lots of good information about black bears and their ways as well as different community-level approaches to resolving conflicts with them.

The Get Smart Bear Society (formerly the Whistler Bear Society), a nonprofit organization dedicated to resolving human-bear conflicts humanely, has a website at *www.bearsmart.com*. The society also has a guidebook to nonlethal resolution of human-bear conflicts that can be downloaded at *www.bearsmart.com/bearsBackyard/Non-LethalGuidebook.PDF*.

Steve Searles has been among the pioneers of adversive conditioning strategies for bears:

P.O. Box 8835
Mammoth Lakes, CA 93546
760-934-6742
Mnthsearles@aol.com
www.bearaffairs.com.

The North American Bear Center is run by Lynn Rogers, Ph.D., an eminent bear biologist, whose close understanding of bears adds significantly to our ability to devise strategies for living in harmony with these animals (*www.bear.org*). This website is packed with information for adults and kids.

Electric fencing kits are sold for bears, especially to be used for temporary installations at campsites or seasonal homes. These generally are sought by those who anticipate encounters with brown bears, but they would work on the smaller black bears as well.

Margo Supplies, Ltd.
www.margosupplies.com
403-652-1932

UDAP Industries
www.udap.com
800-232-7941.

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BOBCATS

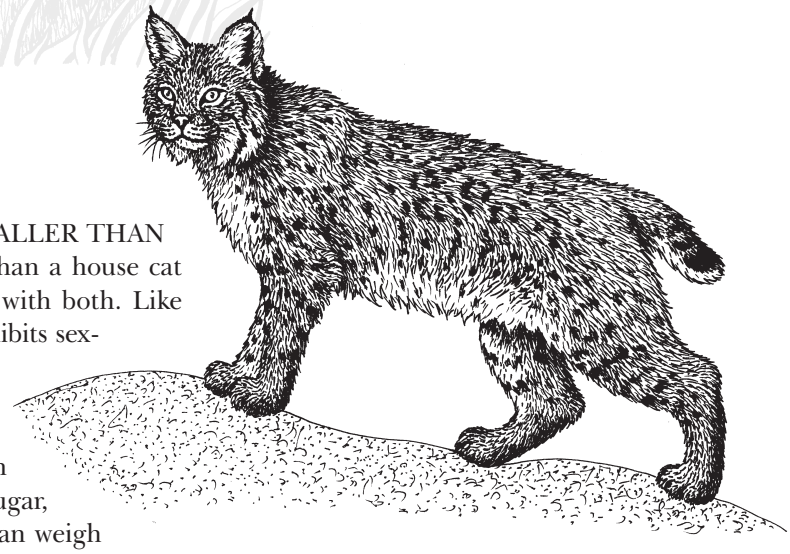


Figure 32 *Bobcat*

THE BOBCAT IS SMALLER THAN a cougar and larger than a house cat but is often confused with both. Like these cousins, the bobcat exhibits sexual dimorphism: in this case the male is larger on average than the female. A large male bobcat can weigh as much as a small female cougar, and a small female bobcat can weigh less than many large house cats—sufficient cause for confusion when trying to sort out all the cats. With a little experience, an observer can soon come to know the distinguishing characteristics of all of these cats and will see that the larger-boned and more muscular body structure of the bobcat readily distinguishes it from house cats, and that the short tail tipped with dark fur is quite distinguishable from the long, sweeping tail of the cougar. Field identification of a bobcat, however, may not be all that critical for most of us, since we would be lucky even to see one of these secretive animals in the wild (Figure 32).

- **Bobcats are true carnivores, eating meat almost exclusively. Unlike their larger cousins, the cougars, who specialize in deer, bobcats are more equal opportunity types—feeding on rabbits, hares, mice, voles, squirrels, grouse, bird eggs, snakes, frogs, and crustaceans.**
- **Bobcats have fiery dispositions, as anyone will discover if he ever tries to pet one as he would a house cat.**
- **Although bobcats are usually shy of human settlements, recent research in California documents that some tolerate human proximity enough to hunt in suburbia.**

Classification and Range

The bobcat (*Lynx rufus*) is distributed more widely in the United States than is its close cousin the Canada lynx (*Lynx canadensis*). While the lynx tends to have a more northerly distribution, being most abundant in Alaska and Canada, the bobcat has a more southerly one. Bobcats range throughout the United States but are absent from a large part of the Midwest. They are believed to have been extirpated from these areas soon after the first settlers arrived, but there is a debate over how numerous they might ever have been there. A number of anatomical features clearly indicate that the lynx is a cold-climate specialist, while the bobcat does well under the many different conditions imposed by warmer and more temperate climes.

Male bobcats tend to be about a third larger than females within the same geographic area. Males average around twenty-one pounds on a frame that is between thirty and thirty-six inches long, while females usually weigh less than fifteen pounds and can be as light as ten to eleven pounds, easily within the size range of many house cats.

Habits

Bobcats are adapted to a variety of habitats, as is obvious from their wide geographic distribution. They do well in even small, forested areas and inhabit open grasslands as well as brush land and semiarid desert, as long as some cover is available. The area a bobcat uses as a home range can vary enormously, from less than one square mile to more than a hundred. Female home ranges tend to be exclusive, and those of males can overlap several female home ranges and sometimes even the ranges of other males.

Bobcats are opportunistic carnivores who will take prey that range in size from mice to adult deer. The general preference for prey appears to fall within size categories, ranging from that of the cottontail rabbit (about two pounds) up to raccoon (about ten to fifteen pounds). Where there are lots of rabbits, the best dietary conditions for bobcats are also believed to exist. Like cougars bobcats may hide large kills under leaves or other plant material and return to finish consuming the prey later.

As seasonal breeders bobcats become sexually active sometime between late winter and early spring. The male and female only associate for the brief period of courtship and mating, after which they go their separate ways; both sexes can have multiple partners. The gestation period is about sixty days, roughly the same as for the house cat. Litter size typically ranges from two to four; older females generally produce more kittens. Bobcats usually have only one litter per year, although a female may produce a second litter if all members of the first litter die shortly after birth. The young usually stay with their mother until the next breeding season, although they only depend on her for food until eight to ten months of age.

Rocky ledges are important habitat elements for these animals, as they provide cover, shelter, and den sites that are suitable for birthing and rearing young. The hollow trees and logs favored by other animals, such as raccoons, are also used occasionally, but not with the great preference given to rock ledges.

Public Health Concerns

Bobcats do not cause any public health or safety problems for humans. Like all mammals bobcats are susceptible to rabies, but the incidence of this disease is very low in these animals. Much like domestic cats, bobcats are known to carry *Bartonella* (cat scratch fever) and *Toxoplasmosis*, but transmission to humans is rare. There is one case on record in which a man caught the plague from a bobcat that he killed and skinned.

Problems

Bobcats cause very few problems for humans. As rare as cases of cougar predation on livestock are, the cases of bobcats killing sheep or other domestic stock are rarer still. Where they do use suburban and even urban areas, bobcats may prey on unprotected house pets, especially their smaller cousins.

Solutions

Tolerance

Traditions die hard, and in some places the bobcat still carries the image of being a dangerous "varmint." Like wolves, bears, coyotes, and cougars, bobcats often carried bounties on their heads and disappeared from all but the most remote and inaccessible habitats. Now that they, like other predators, seem to be returning, we can only hope that a better understanding of and more tolerant approach to them will become the new tradition.

Habitat Management

Feeding pets outdoors should be stopped—or never started. To avoid conflict and protect pets, small dogs and all cats should not be allowed unsupervised access to the outdoors. The typically large home range of a bobcat usually means that sightings and visits by these animals are relatively rare events.

A Last Word

Bobcats maintain such large home ranges and are so secretive that conflicts are unlikely. These animals can be an important, perhaps even critical, part of the balance of nature, even in areas that are fairly densely settled by people. Their almost exclusively carnivorous habits and their preference for rabbits and rodents as prey mean they can help to control populations of these animals. If you are ever fortunate enough to catch a glimpse of these shy cats in the wild, you should feel pleased with your good luck.

Resources

Bobcats don't share the same attention that some of the more charismatic carnivores do, but Kevin Hansen's *Bobcats: Masters of Survival* (Oxford University Press, 2006) is a readable addition to the far too few books about these animals. Hope Ryden's *Bobcat Year* (Lyons and Burford, 1981), still likely to be found on many library shelves, is a delightful popular account as well.

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Canada Geese

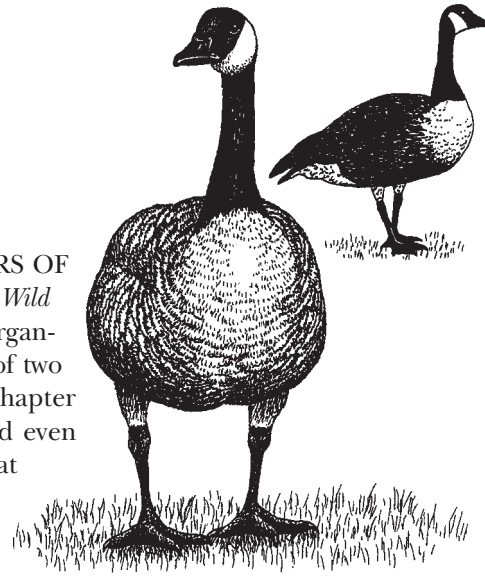


Figure 33 *Canada geese*

WHEN THE EDITORS OF the first edition of *Wild Neighbors* sat down to organize the book in 1996, a vote of two to one put geese into a chapter shared with swans, ducks, and even coots. The thought was that geese were not a big enough deal to warrant a chapter of their own (Figure 33). Today, they deserve a book. Human-goose conflicts have become so prominent, so quickly, that the federal agency that oversees migratory bird management, the U.S. Fish and Wildlife Service (USFWS), is calling for a continent-wide reduction in their population by one million birds over a ten-year period. Because birds will continue to reproduce during that decade, upward of 400,000 geese may have to be killed each year for ten years to meet the USFWS's goals.

Growth can happen quickly with populations of wild animals, and rapid increases in numbers can make it seem that things are out of balance and must be checked immediately. If researchers have learned anything from studies of wildlife, it is that the natural world is a very complex place, for which researchers have only the most superficial understanding and appreciation.

- **Common wisdom is that Canada geese mate for life, but that may have arisen from the fact that until recently no one had studied them closely enough to learn otherwise. While they are generally faithful, it now seems that geese do "get around" more than has been assumed.**
- **There are as many as eleven races or types of Canada geese, with the smallest being only a quarter the size of the largest.**
- **The geese that are so much in the press today are lumped under the misnomer "resident." In fact, our "resident" geese also get around more than people might think.**

Obviously, The HSUS would say this proposed killing of geese is morally wrong. But we would also say that, as has been the case more than once in the past, society's assumptions about how the world works are likely to be wrong as well. Not too long ago, America as a society was united behind the concept that predators were "bad," and their prey species were "good." Millions of predatory animals were killed in that belief, which is now discredited so universally that it seems to us impossible that anyone ever subscribed to it in the first place.

But that is hindsight. Having been wrong before, society not only can be wrong again, but it also almost certainly will be. It is on that cautionary note that we begin this chapter on Canada geese—all to themselves.

Classification and Range

There are several species of native wild geese in North America, but it is the Canada goose that causes conflicts in urban and suburban areas. As the most common large (up to three and a half feet long) waterfowl found on urban and suburban ponds, the Canada goose is easily identifed by its size, brown body, black head, and prominent white cheek patch. (For those who follow the art and science of animal classification, the Canada goose has recently been divided into two main species, *Branta canadensis* and *B. hudsonii*. Between them, as many as eleven subspecies or races have been identified.) The "giant" form (*Branta c. maxima*) is typically identified as the most common "resident" goose, but other western and eastern types seem to have taken to more or less year-round residency as well. Now "resident" Canada geese live in urban and suburban areas in most of the United States (except in the arid Southwest and Hawaii) and in southern Canada. Found in greatest numbers across the northern and middle reaches of the continent, their populations are almost certainly increasing in southern states as well.

Habits

Although traditionally associated with lakes and ponds, geese spend considerable time on land. While it may seem that Canada geese stay in the same local area year-round, they do move short to moderate distances with some frequency, particularly to leave ice-bound winter ponds for open water. What many "resident" birds seem to have forgone are the long migratory movements north and south by which scientists have characterized their kind.

Canada geese find the artificial ponds and lakes, storm water impoundments, and vast expanses of grass typical of parks, corporate office campuses, golf courses, and other human-built environments to be ideal habitat (Figure 34). These birds are primarily grazers, preferring the young tender shoots of grass that are most abundant and accessible in America's fertilized mowed lawns. Geese may also eat waste corn and other agricultural crops, and they always seem willing to take advantage of human handouts.

Canada geese do not usually pair until a rather advanced age (for birds) of about three years. Strong family attachments complement the adults' pair-bonding. Ganders (male geese) help raise the young, and both parents vigorously defend nest and offspring. People often admire geese as attentive and devoted parents.

Breeding Canada geese tend to return each spring to specific nesting sites and sometimes occupy exactly the same nest location as the previous year's. Geese prefer to nest on islands, peninsulas, or shorelines with open sight lines and quick access to water. They also sometimes nest at considerable distances from water but nearly always where they have open sight lines or can find elevated locations such as balconies and flat roofs (Figure 35). In some cities, roof-nesting geese are becoming more and more common.

Canada geese lay five or six eggs, on average, and incubate them for about twenty-eight days. Within a day or two of hatching, parents may lead goslings as far as a mile or two to grass and open water if their nest site



CHRISTOPHER ARNDT / ISTOCK

Figure 34 *Our cities and suburbs provide ideal goose habitat. The grass is mowed to the water's edge, and the pond provides a safe harbor in this municipal park.*

does not offer these essentials. Like most waterfowl, geese make new nests if a clutch is lost and the season is still early.

Public Health Concerns

Canada geese are not implicated in any serious public health threat to humans. Their droppings are sometimes cited as a cause for concern about water quality in municipal lakes and ponds. Sensible park or property managers address the presence of wild (and domestic) animal waste *and* poor water circulation, nutrient loading, sedimentation, overfertilization, monocultural landscapes, and other environmental issues that contribute to the problems of urban and suburban lakes and ponds rather than focusing on one or two species of waterfowl.

Problems

The problems people have with Canada geese are primarily concerns over maintained lawns. The actual grazing done by geese is generally less of an issue than are the fecal deposits and the aggregation of numbers of birds. Droppings can accumulate at considerable rates, and in areas that people use frequently, this is regarded as a nuisance.



THE HSUS

Figure 35 *These geese have chosen to build a nest in a parking lot planter. Nice sight lines and no neighbors to speak of, but hardly the place one would want to raise a family.*

Solutions

Tolerance

As with other urban wildlife, compatibility between geese and people is more the norm than the exception. It seems always the exception that gets the attention, however. When conflicts develop, some people demand quick fixes, and those responsible sometimes take an expedient rather than prudent course of action. However, no single

quick fix will resolve goose conflicts at every site. Integrating a variety of techniques selected to address the factors that attract and retain birds at a particular site, experimentation, and creative thinking are most likely to avoid and resolve conflicts.

"Tolerance zones" complement strategies to keep geese off other places by encouraging communities to set aside areas offering the landscape elements the birds prefer (forage, access to open water, and security). Birds may quickly choose not to rest or forage at specific locations where they are even mildly harassed as long as alternative sites are available nearby.

How Much?

Poop, that is, can a goose produce? Researchers in Michigan spent three days one January at Wintergreen Lake counting, collecting, and weighing Canada goose droppings to answer this question. Why January? The geese rested on freshly fallen snow covering a frozen lake, allowing researchers to see each and every dropping. Each goose pooped an average of twenty-eight times a day. Droppings, which are more than three-quarters water when fresh, each weighed on average 1.17 grams of dry fecal material. That's an average of 33 grams per goose per day, or 0.07 pounds of poop per goose per day.

Feeding

Geese can be attracted to and held at public places by the "generosity" of humans. Handouts may allow these birds to maintain numbers greater than those that might be expected under natural conditions. While the occasional handout is of little consequence, sustained feeding can do more harm than good, and we recommend that communities address this where it is occurring and work with feeders to implement programs that lead to reduction, and if practicable, elimination, of sustained supplemental feeding.

Targeted Cleanup

Since the major complaint about geese is droppings, regular cleanup can resolve this conflict in limited problem areas. Walkways can be hosed or swept, and specialized landscaping equipment can sweep up goose droppings as well as other waste from turf and walks. Good short-term measures, while long-term solutions are considered, these may be particularly appropriate at sites where geese congregate for short periods each year before dispersing, such as at molt sites.

Habitat Modification

The most lasting approach to limiting a site's use by Canada geese, and often the most cost effective, is to alter the habitat to make it less attractive. The goals in modifying habitat are to reduce food, reduce preferred nesting and brood-rearing areas, and increase the birds' sense of insecurity and wariness about potential dangers.

Canada geese prefer to eat young shoots of grass, so reducing the total amount of lawn area and the availability of young shoots within lawn areas will make a site less attractive to them. Replace mowed, fertilized grass with other plantings or materials; leave grass to "naturalize" to at least six inches high and leave tall grasses to overwinter; and end or reduce fertilizer use and supplemental watering to limit young shoots.

Geese feel safe from predators where vegetation is low, allowing open sight lines, and where they can readily escape into open water. Change plantings along shorelines to create a real or visual barrier by establishing long grasses, shrubs, or other dense, tall plant cover at least thirty inches high and twenty to thirty feet wide (Figure 36). Fences, hedges, boulders, and a continuous band of tall, emergent aquatic plants such as cattails and bulrushes at the shoreline can be used alone or in combination with other elements to create a barrier.

Exclusion

Since geese can fly and walk into a site, it is difficult to exclude them completely. These large birds can be prevented from landing on small bodies of water (swimming pools and smaller storm water retention ponds) or forage sites by erecting a grid of overhead wire high enough above the ground that it does not interfere with people underneath. The grid panels need to be no closer than twenty-five feet apart, and a perimeter fence can prevent birds from walking under the grid.

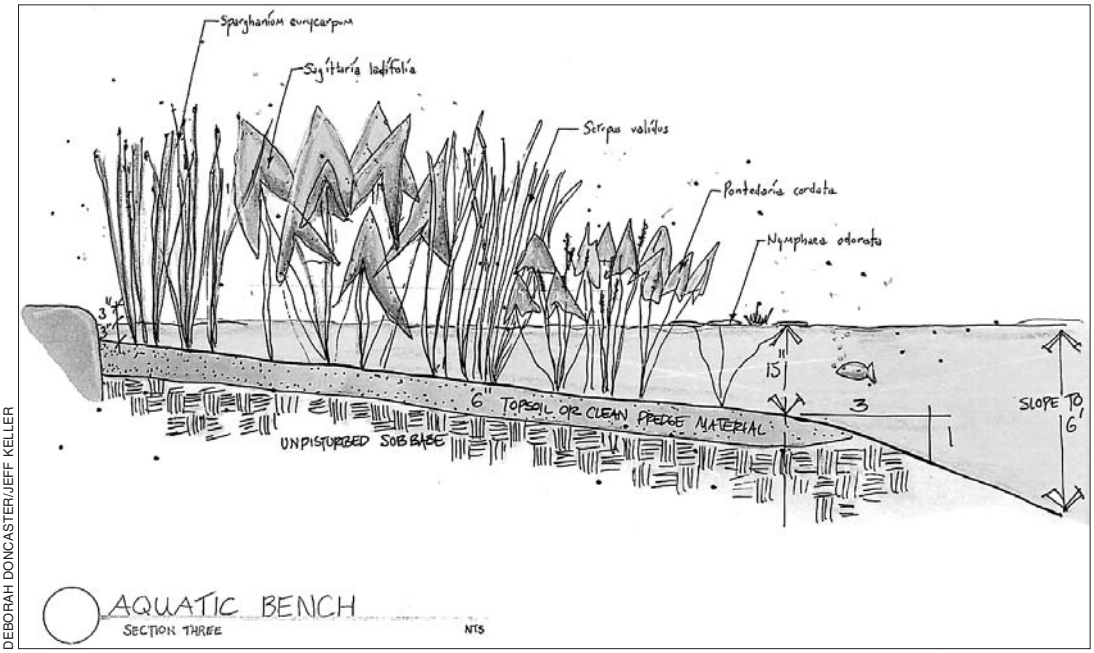
Fences are effective in excluding geese tending flightless young or any adult who is molting and cannot fly. Pond edges should be fenced completely so geese cannot simply walk through an opening. One retractable two-strand fence is commercially distributed specifically as a goose fence.

Scare Devices

Like many other birds, geese will lose their fear of most scare devices over time, so effectiveness of scare devices often declines with repeated use. Using a number of different devices, moving them around the site every few days, and combining devices with other techniques (such as habitat modification) will ensure that geese do not habituate quickly.

Several staple strategies for resolving bird conflicts have been tried on geese, including small homemade flags, eyespot balloons, and Mylar® tape. Marketers claim floating plastic alligator heads that move with water current or coyote effigies moved by automated devices scare geese away, but as with any device of this sort, the buyer should beware (and get a money-back guarantee of satisfaction). Finally, the motion-activated sprinkler, sold to scare animals from yards and gardens, might be effective for smaller areas with light bird use, especially if it is moved frequently and combined with other techniques.

Some commercially available lasers have been designed specifically to scare birds. Used under low light conditions or at night, they cause considerable alarm in certain bird species, including geese, and have proven effective for scaring them away from night roosts. When harassed with lasers at night, geese usually go to different forage areas the next day and do not seem to habituate to the



DEBORAH DONCASTER/JEFF KELLER

Figure 36 *Habitat management for geese will greatly reduce conflicts. Here, there are plans to install an aquatic "bench"—shoreline plantings that will diversify and beautify the water's edge while serving as an impediment to the comings and goings of geese.*

experience. Flashing or rotating strobe lights may achieve the same goal of denying birds their night roost.

Agricultural operations may use pyrotechnics and propane cannons to create explosive, disruptive noises that frighten birds. Geese may habituate rapidly to such devices, especially resident geese accustomed to urban noise. A commercially available device that plays recordings of goose distress calls has had some success at convincing geese to avoid limited areas, according to some reports.

Trained Dogs

Using techniques developed over hundreds of years to manage livestock, trained herding dogs are used increasingly to frighten away geese. For the safety of all involved, hazing should be restricted to certain herding breeds (border collies being perhaps the best candidates) and to dogs who are trained and handled responsibly. Increasing numbers of commercial businesses are offering dog services to communities and properties.

Repellents

Two chemicals, anthraquinone and methyl anthranilate, are registered in the United States for dispersing birds. Both have been tested and proven effective with Canada geese in controlled situations when used according to the manufacturers' instructions. Methyl anthranilate may also be dispersed into the air from special equipment as a fog that irritates geese and other birds so they leave the area immediately.

Limiting Flock Growth

Where conflicts exist or are developing, it may be prudent to limit goose population growth by egg addling (see chapter 8). This can have an impact on flock size and site fidelity, since geese hatched on a site will prefer it as a nesting site themselves when they come of age. In urban and suburban areas, concentrated nesting sites often make these addlings highly feasible and successful. Limiting reproduction requires a long-term commitment to have any significant impact on flock size, because it only reduces potential young added to the flock, not adults.

Geese and Dogs

Geese may leave when untrained and unhandled dogs roam a property or family pets chase them. However, if a dog harms a goose, it is a violation of federal law by the dog's handler or owner. If a dog harasses geese defending nests or young, either the geese or the dog may come to harm. Without training and handler direction, untrained dogs are often not effective over the long term. Geese can habituate to dogs used this way and learn that they can readily flee onto the water whenever a dog approaches.

Planning

Managing conflicts with Canada geese can range from a need to shoo them off a back lawn to trying to convince a flock of a hundred birds that has used a municipal park for thirty years that they ought to go elsewhere. The former may not require a plan, but the latter definitely will. Coordinated, synchronized, and systematic approaches to resolving conflicts with Canada geese do not require a great expenditure of time and effort and may, in fact, save resources by focusing the many different strategies for resolving problems with geese nonlethally at biologically appropriate times. Lethal goose management (roundup and slaughter) has become highly controversial, driving communities in opposing directions, as those who advocate killing birds confront those who are equally committed to nonlethal conflict resolution. An integrated nonlethal plan can resolve conflicts not only between people and geese, but also among people themselves.

A Last Word

Not so long ago, the presence of Canada geese on a neighborhood pond was an unusual enough sight to draw a crowd. Today the crowds are composed of geese, not people. By 1900 overhunting and market killing of all forms of Canada geese had reduced their populations to historic lows. Landmark legislation protected the dwindling numbers, but experts thought that one type, the "giant" Canada goose, had vanished.

In the early 1960s, small flocks of "giants" were discovered, and federal and state agencies began a concerted effort to rebuild their populations. Geese were bred and raised in captivity to bolster numbers, and young birds were introduced where they had been absent for many decades and sometimes where they may never have ranged before. These geese weren't, by nature, strong migrants to begin with, and, removed from parents and migrating flocks, they simply abandoned this behavior pattern altogether. Having worked so hard to propagate and distribute geese, America seems bent on countering that success by proposing to kill enormous numbers of them. Ironic, illogical, and indefensible are all appropriate adjectives for this situation.

Resources

Bernd Henrich's *The Geese of Beaver Bog* (HarperCollins, 2004) pretty much dispels the myth of geese being faithful mates for life. But in a way that only an accomplished observer of animals such as Henrich can, it introduces the truth that these birds are individuals, each with a unique life history and personality. If more people understood this, our interactions with geese would be very different, indeed.

The HSUS has a number of additional resources on geese available at its website (*www.humanesociety.org/wildneighbors*). And a DVD/CD package is available for purchase that can serve as a resource for communities attempting to better understand the issues surrounding geese and the available humane solutions.

GeesePeace is a nonprofit organization that helps communities humanely resolve conflicts with Canada geese. It promotes innovative, farsighted, and inspirational methods that work.

www.geesepeace.org
6405 Lakeview Drive
Falls Church, VA 22041
703-354-1713/(fax) 703-354-1940

Seasonal fence to exclude geese and other waterfowl from docks and along shorelines is sold mainly by lake management firms; these offer the kit on their websites:

Aerators Aquatics 4 Lakes N Ponds
www.virginialakemanagement.com
757-591-8780

Green Touch
www.greentouchirrigation.com
866-401-8150

Lake Restoration, Inc.
www.lakerestoration.com
877-428-8898.

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Chimney Swifts

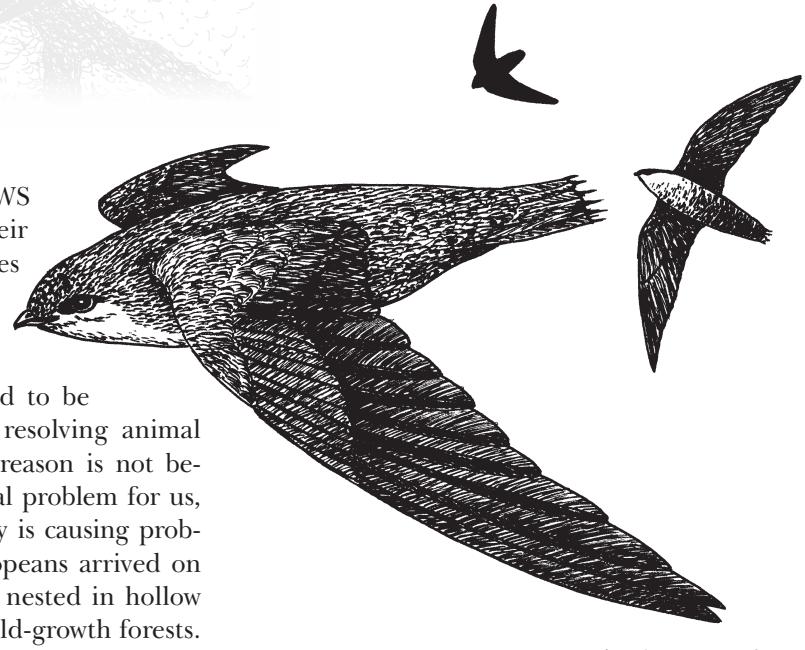


Figure 37 *Chimney swift*

Anyone who knows these birds, with their cigar-shaped bodies almost constantly aloft, chattering while sweeping insects out of the sky, will wonder why they need to be mentioned in a work on resolving animal conflicts (Figure 37). The reason is not because they cause any special problem for us, but because modern society is causing problems for *them*. Before Europeans arrived on this continent, these birds nested in hollow trees—the aged giants of old-growth forests. These trees were lost when the land was cleared for agriculture, which might have had a devastating impact on swifts, except that humans quickly put up houses with stone and mortar brick chimneys that were almost exact replicas of the nesting trees. Now we encourage the practice of capping chimneys to prevent conflicts with other species and build many houses without any fireplaces or chimneys, in essence taking nesting habitat away from these birds. This reminds us that everything is interconnected and part of a larger picture—a living environment, of which this work addresses but one small part.

- **The earliest recorded date for a chimney swift using a chimney in North America is from Maine: 1672.**
- **Prodigious insect eaters, swifts spend almost all their time in the air, only coming down to roost at dusk or to feed their young.**
- **Swifts are closely related to hummingbirds.**

Classification, Range, and Habits

There are several species of swifts in the United States, but the chimney swift (*Chaetura pelagica*) is the most common and widely distributed. Chimney swifts migrate between North America and Peru, making a six thousand-mile round-trip journey every year to pursue their insect prey, which they take from the air in amazing quantities. They are easily recognized on the wing, with their gray cigar-shaped bodies, constant wing beats, and staccato vocalizations, but few people ever see them at rest. Chimney swifts are so specialized in their adaptation to clinging on vertical surfaces that they cannot perch or stand on their legs in the way most other birds do. The feet of the chimney swift have four grappling hook-shaped toes with claws that can hold onto a rough surface and partly support the bird, while stiffened tail feathers, with their exposed spiny tips, also bolster him. These traits have allowed swifts to make the adjustment from trees to chimneys.

If swifts are in a chimney during spring or summer, it is almost always a single breeding pair. Varying somewhat from north to south, swifts brood and raise their young between June and August. As they prepare to migrate south in the early fall, swifts congregate, sometimes in the hundreds, to use a single chimney as a roost. The nightly return of foraging birds is impressive, as they dart into the chimney at dusk with an uncanny synchronization that must be highly organized, even if it looks confused.

Problems

Today many houses are built either without chimneys or with chimneys that use smaller metal flue pipes rather than clay liners. These metal flues can sometimes be death traps for animals, who cannot grip the slippery metal and may even fall into the fireplace. Swifts nests are small, cup-shaped structures constructed of small twigs and glued to the chimney wall with saliva. They are not a fire hazard (they are far too small for that), but they should always be removed after the birds have left in the fall. This does the swifts a favor: it removes bird parasites and the nest structure itself, which might be used by returning swifts and be unstable enough to collapse during the nesting period. Swifts do tend to return to the same nesting site year after year, if it is available.

Solutions

The rules regarding swifts in chimneys are simple. First, delay the annual cleaning until after young have left the nest. Although you may hear the noises of young birds as they beg for food, the twittering is only temporary and should be tolerated. Ask your chimney sweep to come back in the fall if swifts are in occupancy earlier in the season. Professional sweeps should know that swifts are protected under the Migratory Bird Treaty Act. Anyone who knowingly destroys birds or nests that might contain eggs or young can be fined or penalized. Chimneys lined with metal should always be capped, since birds entering these structures can easily become trapped.

A Last Word

One approach to dealing with diminishing nesting habitat for swifts is being undertaken by the Driftwood Wildlife Association, Texas Partners in Flight, and the Nongame Urban Program of the Texas Parks and Wildlife Department. The North American Chimney Swift Nest Site Research Project designs and tests alternate nesting structures for swifts. The most elaborate of these is an extra-large birdhouse—really an artificial chimney, twelve to twenty feet high and two feet by two feet in dimension. Monitoring and testing efforts seek to perfect efficient, inexpensive structures and to determine how best to place and maintain them.

Additional Resources

Margaret Whittemore's *Chimney Swifts and Their Relatives* (Nature Book Publishers, 1981) is a delightful account of these birds and their Old and New World relatives, full of interesting facts and historical information.

Anyone seeking more information about swifts can contact the Driftwood Wildlife Association, 1206 West 38th Street, Suite 1105, Austin, TX 78705, *www.chimneyswifts.org*. The association publishes a newsletter (*Chateura*) that provides useful information on these birds and how to help conserve and protect them. It also provides building plans for the swift houses mentioned above.

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CHIPMUNKS



Figure 38 *Chipmunk*

PEOPLE WHO live near a woodlot of any size are likely to have some sort of chipmunk as a neighbor. Although most common in forests, these little ground squirrels also make their homes in yards, where they're seen most often in and around stone walls, under walkways or patios, or in gardens. These are completely enjoyable animals, and there's a lot more to say about the pleasure that comes from having them around than about any problems they may pose.

A few quiet moments in the woods, sitting and watching, reveals one, close by, then another, farther away, and another, and sometimes even more going about their own business. It is clear that these animals are aware of one another, and a disturbance or threat that frightens one spreads rapidly to the others through the cascade of scolding barks used to signal alarm. All become alert and, if the disturbance is real, disappear into holes that are barely noticeable even after having watched the animals use them. Then they come out, cautiously, to resume the serious business that was interrupted (Figure 38).

- **Chipmunks typically have home ranges of less than a square acre, with activities focused on the most easily accessible feeding sites within that area.**
- **Although chipmunks hibernate from late fall to early spring, they also wake up every couple of weeks to eat some of their stored food.**
- **The burrow of one chipmunk that lived to the venerable age of six was accessed by at least thirty different entrances over its lifetime.**

Classification and Range

Chipmunks are a member of the same family of rodents as tree squirrels, flying squirrels, ground squirrels, prairie dogs, and marmots (the *Sciuridae*). There is one species of eastern chipmunk (*Tamias striatus*) and a number of different species of western chipmunks. There is a single species of chipmunk found in the Old World as well and a number of animals called ground squirrels, some of whom look a lot like chipmunks. The eastern chipmunk ranges throughout the eastern part of North America into all but the far North and Deep South and westward to about the middle of the continent. The western species take up where the eastern leaves off and virtually cover the rest of the continent.

Chipmunks are commonly distinguished by the broad stripes along their backs. The eastern chipmunk is larger than most of the western species, reaching ten inches (with tail) and weighing two to four ounces.

Habits

Chipmunks tend to favor deciduous forests with plenty of beech and oak trees, although the diversification of western forms clearly includes some real habitat specializations too complex to go into here. They may be most common around the edges of woods, where they can also forage out into other habitat to add to their larder. Chipmunks readily adapt to suburban gardens with natural landscaping and often dig burrows around rock and woodpiles, retaining walls, and fallen logs. They can climb trees easily but spend much of their time foraging along the ground. Chipmunks are active by day (diurnal).

Chipmunks depend primarily on plants for food, concentrating on seeds and berries as well as acorns and other nuts. They also occasionally eat insects, worms, small reptiles and amphibians, eggs, and, in rare instances, birds. Like squirrels, their foraging is most intense in the fall as they gather food to store and use over the winter. Transporting food to larders is facilitated by the expandable cheek pouches into which quite a lot of material can be crammed—as anyone who watches these animals for long finds out. Chipmunks sleep through much of the winter but awaken periodically to eat stored food and may even appear out and about during warm spells.

Mating begins as chipmunks emerge from their winter sleep in early spring (late February to early April) and often occurs again in the summer to produce two litters, each of four to five young. The young venture from the burrow after about six weeks and set out on their own within the next two weeks. Western chipmunks only breed once a year unless a female loses her litter, in which case she may conceive again.

A number of investigators have excavated chipmunk burrows to reveal their internal structure. Two types of systems have been discovered. The first is relatively simple, with one or two tunnels leading to a single chamber that is probably only a temporary home used by young their first winter. The others are much more complex, with multiple openings and tunnels leading to nesting chambers, food storage areas, and as much as a hundred feet of tunnel. Like many burrowing animals, chipmunks use tree roots, rocks, sidewalks, and any other firm object as support above their excavations. Stone walls are especially good for this purpose and provide cover as well for coming and going to tunnel entrances. Sometimes tunnels appear close to reliable food sources, such as bird feeders, even when this leaves the chipmunks rather exposed.

Public Health Concerns

Chipmunks are not considered to be a significant source of any infectious disease transmissible to humans.

Problems

Chipmunks do not usually cause property damage, although they sometimes are said to injure ornamental plants as they harvest fruits and nuts. It is easy to attribute squirrel damage to chipmunks and, unless an offender is

caught in the act, often impossible to tell which species is involved when both are present. Like squirrels, chipmunks occasionally dig up and eat spring flowering bulbs, such as crocus. Some people get annoyed when chipmunks burrow in flower beds or under sidewalks and porches. We do not know of any documented case, however, where a chipmunk burrow has caused structural damage. Chipmunks found indoors are there accidentally and will leave as soon as the homeowner provides them with a means to do so.

Solutions

Tolerance

Most people enjoy watching these attractive animals, thinking the enjoyment outweighs any nuisance they may cause. We agree, although we sadly note that every year we are contacted by individuals who feel they cannot tolerate chipmunk "damage" of the sort caused by their tunnels under walkways and in the yard. Some wildlife-control businesses even trap and kill chipmunks for a fee and facilitate unreasonable and unrealistic concerns about these animals. We mention below a couple of the common methods of excluding or repelling these animals from yards, while trying to stress that only very rarely, if ever, is it necessary to use them.

Exclusion

Chipmunks may be kept from burrowing around foundations, sidewalks, porches, and retaining walls by using an L-shaped footer. Removing wood or rock piles and trimming back plantings that provide cover or food sources around the problem area should also discourage chipmunks. Surround the area, if you must, with a plant-free gravel border to prevent further conflicts. Flower bulbs may be protected from burrowing chipmunks if planted beneath a wire or plastic screen ground cover or in bulb cages. This mesh should be large enough (one inch by one inch) to allow plants to sprout but small enough to prevent chipmunks from digging.

Repellents

There are no repellents registered for use on chipmunks, undoubtedly because they have never been identified as causing significant enough damage to merit the elaborate series of tests necessary for approval. Commercial repellents labeled to repel squirrels will also repel chipmunks where both species are implicated in damage. Bulbs soaked in a Thiram-based repellent before planting may deter chipmunks, or you may just plant daffodils (*Narcissus*) for spring flowering, since no wild animal we know of bothers these bulbs. Most wildlife also avoid flowers bulbs in the genus *Allium* (this group contains garlic and onions).

Feeding

Bird feeders will attract chipmunks, and if their presence is deemed a problem, pick up spilled seeds and secure feeders from access. Since both birds and chipmunks are active by day, this may be difficult, however. Chipmunks certainly will not favor thistle seed as much as they do sunflower seed, and they're not wild about safflower and other seeds either.

A Last Word

If you have chipmunks in your yard, enjoy them.

Resources

Although it is out of print, Lawrence Wishner's *Eastern Chipmunks: Secrets of Their Solitary Lives* (Smithsonian Institution Press, 1982) remains available and is a must for anyone interested in the lives of these animals.

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Cougars

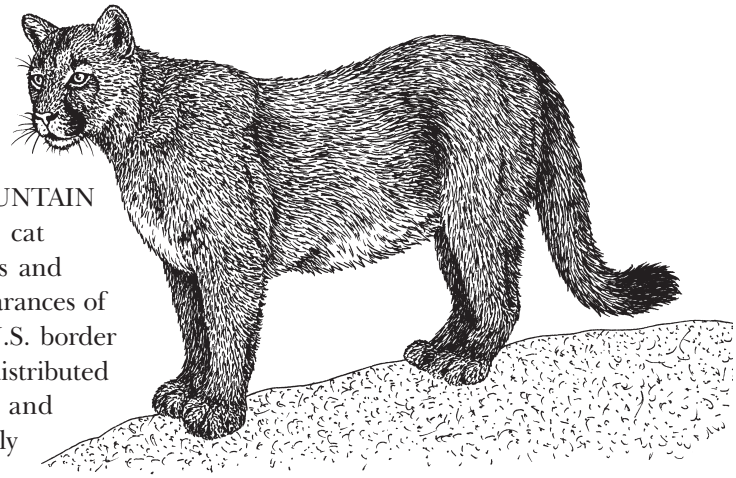


Figure 39 *Cougar*

THE COUGAR—AKA MOUNTAIN lion—is the largest wild cat found in the United States and Canada, except for the rare appearances of jaguars along the southwestern U.S. border with Mexico. Cougars were once distributed throughout almost all of North and South America but are now greatly diminished in number and range. Their demise follows the usual pattern: persecution by humans and loss of habitat. With bounties and a concerted commitment to eradicate these animals as "varmints," federal agents destroyed tens of thousands over a period of a few decades. Cougars are now protected in many areas and are "game" animals (with regulated hunting and trapping allowed) elsewhere. The difficulty of monitoring these elusive, solitary animals leaves a great deal of uncertainty regarding effects on cougars from habitat loss or fragmentation and the potential for overexploitation by hunting or trapping (Figure 39).

The spread of human development into cougar country is at least partly responsible for recent increases in human-cougar contacts. There has also been an increase in attacks, injury, and even fatal encounters. Such events are still very rare, however, and

- **Cougars are the largest wild cats currently maintaining breeding populations in the United States.**
- **Cougars are highly secretive, and some wildlife-savvy folks say that you only see a cougar when he wants to be seen.**
- **It is likely that there are more names for cougars than for any other animal in the world—in North America alone there are twenty-five Native American and forty English monikers in use.**

more people are killed by bee stings *each year* than have been killed by these big cats in all recorded history. Nonetheless, fatal cougar attacks are national news. As a result, cougars will be a species of special concern for the foreseeable future.

It is sensible and appropriate to seek ways to minimize the risk of attack by cougars. It makes no sense at all, however, to attempt to control the entire species, rather than just the offending animals. Harkening back to the turn of the century, when predators were universally regarded as "bad" animals, the cougar is coming under renewed pressure by those arguing for large-scale population reduction. Wildlife watchers now know that there are no "bad" species: each serves a purpose in nature's scheme of things. Some are ready, however, to make a mistake as tragic as that of our forbearers in persecuting whole populations of these big cats for the harm done by a few individual cougars.

Classification and Range

When Europeans first arrived in the New World, the cougar (*Puma concolor*) was one of the most widely ranging mammals they encountered. The historic range of the cougar, from the tip of South America north, into southern Canada, was rivaled only by that of the gray wolf, which may have been the most widely distributed land mammal on earth. Almost immediately upon European settlement, the eastern population of cougars was pursued to near extinction. Today, only a small remnant population remains in the Florida Everglades, with the majority of cougars in the United States found west of Texas. Cougar sightings in some parts of the Midwest and eastern United States have increased in recent years, raising the possibility that early colonizers are probing some parts of their former range. However, such sightings are confused by the possibility of escapes from the backyard pens where many "pet" cougars are confined in parts of the country.

Cougars are large and formidable predators. Males are typically almost 50 percent larger than females, averaging between 120 and 150 pounds, compared to about 75 to 100 pounds for females. Including the tail, males can be more than six feet long, while females are usually about five feet long. The long tail itself is a key to identifying cougars because the only similar-looking animal that might share the same habitat is the bobcat, who has but a stub to call a tail.

Habits

Cougars range throughout a wide variety of habitats, but they seem to prefer fairly large undisturbed areas with vegetation suitable to supporting deer, their favorite prey. They may prefer transitional habitat—for example, areas where forest meets meadow—that provides sufficient cover to allow them to ambush their prey. Humans' settlements or cut forests tend to be avoided. Cougars' ability to move long distances means they might appear in seemingly inappropriate habitat areas, even places densely settled by humans. Such appearances are almost always brief, with the animal moving along quickly, if allowed, in search of a suitable permanent home.

Cougars are exclusively meat eaters, or carnivores. Although they will eat a wide variety of small- to medium-size mammals, such as porcupine, raccoon, and opossum, deer are generally recognized as their preferred prey. Indeed, there may be considerable validity to the theory that cougars are more present in suburbia today, drawn by the enticement of growing deer populations.

Many of the long-range movements male cougars make occur during searches for sexually receptive females. Cougars do not appear to form lasting male-female bonds, however, and the sexes avoid one another after mating. Female cougars may produce kittens at any time of year, though there are certain times, such as summer, when most births occur. Gestation lasts about three months, with one to six (averaging two to three) kittens born in a

litter. The sites chosen for raising kittens are often quite open and may not appear to humans to be suited to this purpose; however, these sites are apparently quite acceptable to the cougar. The kittens will stay with their mother until the spring following their birth. Due to this extended maternal care, females usually breed only every other year. Orphaned kittens as young as six months old have been known to be able to fend for themselves, though kittens orphaned before the age of nine months typically cannot survive on their own.

Adult cougars are territorial and do not typically associate with one another. When more than one cougar is sighted in an area, it is likely either a female who is temporarily sharing her territory with her nearly grown offspring before their dispersal, or a pair that has been mating.

Public Health Concerns

Cougars do not carry any communicable diseases that are regarded as threats to the public health, although they can get rabies. Even so, there has only been one recorded incident of a rabid cougar attacking humans.

Problems

The most frequent damage these animals do is to prey on livestock and pets. Cougars will kill even fairly large animals, including cattle, although, like most predators, they prefer young or smaller prey. Estimates of the impact on ranchers are debated, but statistics from the USDA's National Agricultural Statistics Service show that the number of cattle and sheep lost to cougars is considerably less than the number lost to other factors, such as weather or disease.

The amount of money spent to "control" cougars considerably exceeds the economic losses due to their predation. Nonetheless, individual livestock ranchers may be hard hit when a cougar repeatedly preys on their herd. As is always in such cases of depredation, it is the individual animal who is a problem, not the population at large. Cougar attacks on humans are increasingly regarded as potential problems in some parts of the country, even though they are very rare. Cougars will attack and kill unattended pets opportunistically.

Solutions

Tolerance

Cougars are shy of human contact and are rarely seen, although they may appear calm and confident when encountering humans. This attitude can be alarming to people who expect all wild animals to be fearful of humans. Understanding these animals and their habits, along with appreciating the fact that they may be close neighbors, is the first step toward living compatibly with them. Simply seeing a cougar, or signs that a cougar has passed through, are not justifications for alarm and do not mandate removal of the animal.

Vigilance

Cougars who have attacked or injured people are tracked and killed whenever possible. This targeted action is deemed necessary, because it is highly likely that the same cougar will attack again. Targeting animals who have not threatened humans or reducing populations through regulated hunting serves no real purpose. They are not appropriate solutions to, or prevention for, cougar attacks.

Some simple steps can minimize the possibility of encounters where people live in areas also populated by cougars. One of the first is merely to be more attentive and alert. Be aware that you may encounter a cougar some day and remember the best way to react should that happen. An important caution is not to run if a cougar is encountered: this may simulate prey behavior and provoke an attack. Remain standing and try to appear larger, by raising your arms or opening your jacket. An umbrella rapidly opened and closed while facing the animal can be highly intimidating, however foolish one might feel

about carrying an umbrella in the backcountry. Otherwise, throwing rocks or sticks and yelling are advised. *Do not approach* the cougar and expect to intimidate him. It will not work.

In the unlikely event of an attack, fight back in any way you can. People have stopped attacking cougars by hitting them with sticks, their hands, baseball caps, and even garden tools. Hike, jog, or bike with a partner when using backcountry trails, and keep children and companion animals especially close by when hiking. It is prudent to keep your dog on a leash, and, in many parks and backcountry areas, it is required. Leaving dogs, cats, or any small pet outdoors in cougar country, especially at night, is a bad idea.

Although there are no registered repellents for use on cougars, the pepper (capsaicin) sprays sold to deter attacks by dogs, bears, and humans or even a fire extinguisher should be effective in the extreme unlikelihood of a close encounter with one of these cats.

Choose a Different Pet

There is everything wrong and nothing right about keeping these animals as pets.

A Last Word

Like many species of wild animals that were persecuted and hunted nearly to extinction, the cougar is making a comeback. A lot of the credit for this has to go to the cougars themselves, because it was only through their hardiness and adaptability that they managed to survive when people were bent on exterminating them. Some people still are. Like other large predators, these animals can truly be dangerous. But these dangers are so rare that people have to recognize another, more deeply rooted psychological fear of predators that dictates their reactions to them. More than with the animals themselves, it is this fear with which people have to come to terms.

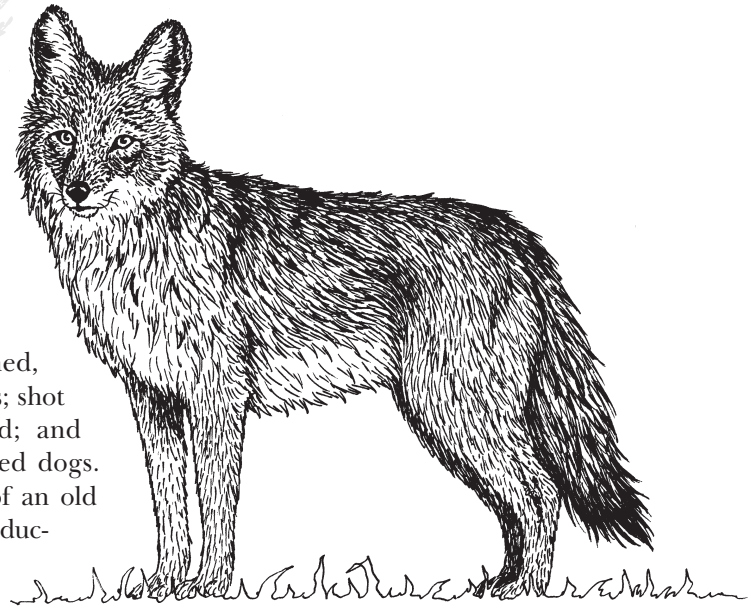
Resources

Any number of books about these animals can be found through a simple search. One that has good information about those in the southwest is Kenneth Logan and Linda Sweanor's *Desert Puma: Evolutionary Ecology and Conservation of an Enduring Carnivore* (Island Press, 2001).

The Mountain Lion Foundation (*www.mountainlion.org*) and The Cougar Fund (*www.cougarfund.org*) are devoted to protection of, public education about, and awareness of mountain lions.

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COYOTES



THE COYOTE HAS been one of the most persecuted animals in North America. Coyotes have been hunted, trapped, poisoned, dug and dynamited out of dens; shot from the air; gassed; burned; and caught and killed using trained dogs. This mayhem has been part of an old struggle between livestock producers and coyotes in which more enmity than understanding always seems to have existed. Some of those feelings may be transferring to urban and suburban communities as coyotes begin to probe and move into those habitats (Figure 40).

Figure 40 *Coyote*

By killing unwary coyotes, human beings have left behind only the most wary and best adapted animals to survive and reproduce. This selective pressure has effectively created an animal perfectly adapted to thwart humanity's attempts at lethal control and persecution. New strategies, newer tools, more extensive programs, and more and more resources are aimed at killing coyotes, to less and less effect. The few voices that suggest acknowledging coyotes as an important part of the natural scene sadly remain largely

- **The word coyote is derived from the Aztec *coyotl*, which loosely means "trickster."**
- **This animal's sharpened instincts, adaptability, intelligence, and hardiness were well known and respected by the first Americans, in a way that later colonizers seem to have been unable to fathom.**
- **Within the last few years, coyotes have completed a westward to eastward expansion that now includes all of the eastern states.**

unheard amid the demands for ever more aggressive lethal control efforts.

Classification and Range

The coyote (*Canis latrans*) is a member of the same family as foxes, dogs, and wolves. Coyotes were restricted no more than 150 years ago to the prairie grasslands of the western United States and Canada. In the intervening years, they have moved north into Alaska, west to the Pacific, south into Mexico, and east across the Mississippi. These canids have even been removed from Central Park in the heart of New York City, a tiny island of forest surrounded by a vast expanse of concrete and steel. Coyotes somehow managed to traverse miles of urban habitat and cross major bridges, the only means of entry into New York besides tunnels, without being detected.

Coyotes freely interbreed with other canids, and as they began to colonize the eastern United States, there was much talk of "coy-dogs," crosses between domestic dogs and coyotes. These certainly have happened and undoubtedly continue to happen, along with rarer hybridization events between coyotes and wolves. What these events contribute genetically or otherwise to the populations of modern coyotes is still being worked out.

Habits

Coyotes have adapted to virtually all biomes (areas habitable to wildlife) in North America. They may prefer grasslands, wooded hill country, or wooded drainages, in part, because these are areas where prey is common, but they are also found in scrub, deserts, alpine heights, and the subarctic tundra. Fox and coyote territories may overlap, but the presence of coyotes usually depresses fox numbers, just as wolves depress coyotes when both are present. Coyotes are territorial, with the males marking their boundaries at urine signposts, as many other canids do. The size of the territory is directly related to the quality of the habitat, and it often can take several square miles to support a coyote family.

Coyotes are opportunistic feeders who eat an astonishing variety of plant and animal foods. In most settings their diet may be weighted heavily toward rabbits (or hares) and rodents, such as voles, with occasional vegetable foods, such as berries and acorns, and some insects to round out the menu. In urban settings, pet food, occasional pets themselves (primarily cats), human food wastes, and garden vegetables become alternative food sources. Coyotes are capable of inflicting substantial damage to livestock, primarily during the birthing season, and this is the characteristic that most brings them into conflict with people—not to mention their fondness for agricultural crops such as melons.

Coyotes probably mate for life, although not as much is known about pair bonding between male and female coyotes as is known about the lifelong bonds between wolves. Throughout most of their range, coyotes breed during February or March and give birth in April or May. The den may be an enlarged fox burrow, a rock ledge or cave, or a shallow pit under a windblown tree. Litter size varies, depending in part on environmental conditions and coyote population density. Gestation averages sixty-three days, with an average litter size of six pups in older females. One- and two-year-old females tend to have smaller first litters, averaging three pups. There is some evidence that when they are severely persecuted and at low population densities, coyotes produce larger litters. Recent studies have also revealed that eastern coyotes form social packs of five or more individuals, although the reasons behind these formations remain unclear.

A female coyote nurses her pups for up to two months, but she starts offering regurgitated meals as early as three weeks after birth. This form of feeding is widespread among canids and represents an economical way of weaning young from milk to semisolid meals. (It is also a convenient way to transport food for animals, who do not use shopping bags.) The pups mature quickly and are fully independent at about nine months. The male coy-

ote provides protection and food for the mother and offspring until the youngsters are able to hunt for themselves.

Public Health Concerns

Coyotes, like all warm-blooded animals, may contract rabies. Their close kinship to dogs places coyotes at greater risk where there are populations of unvaccinated domestic dogs. Recent advances in rabies control using oral baits to immunize wild animals without having to capture them have made controlling the spread of rabies in coyotes much more feasible than in the past.

Problems

In the west the long bitter war against the coyote as a livestock predator is its own issue. Entire books have been written about it; hundreds of thousands, if not millions of coyotes have suffered and died; and it has become a sad chapter in the history of human-animal relationships. It is even sadder now to see much of the bitterness and misunderstanding transferring from range to suburb.

In cities and towns with suitable habitats, coyotes will kill free-roaming pets and occasionally do some damage to home gardens. As coyotes move into these areas, exactly how much conflict there will be remains to be seen. First contacts are being made only now as coyotes make their way into this new environment.

Solutions

Tolerance

People often live with coyotes nearby and never see them. Occasional night choruses are the only evidence that they are there. Unless they cause a specific problem, there is no point or purpose in "controlling" coyotes. Even in the most intense battlegrounds on western range land, the negative perception of these animals and the former acceptance of an imperative "need" to control their populations are changing, although slowly. Some ranchers now attempt to capture or kill animals only when predation has occurred; the offending individual or pair is targeted for removal and other coyotes are left unmolested. This strategy recognizes that it is better to leave coyotes who do not kill livestock as territorial residents, so they will keep coyotes who might kill livestock away. We think the same strategy would hold true for suburbia.

Domestic Pet Care

Individual coyotes can be serious predators on cats and small dogs. Coyotes are primarily nocturnal, but the best way to minimize risk to pets is not to leave them out unattended at any time. Cats, in particular, should not be allowed to roam freely; ideally they should be kept indoors. Some people may find it hard to accept this as the best practice for the well-being of their pets, but it is, and society is only now beginning to realize and act on the many reasons—from pet safety and health to preventing cats from killing wildlife—that make it so.

It is most important not to attract coyotes by leaving any pet food, water, or food waste storage areas available to them. Good housekeeping and securing trash will discourage coyote activity near residences. Where cats are left outdoors and there is little natural tree cover, you can help protect them by installing "cat posts." These can be any type of long, climbable wooden post (four inches by four inches or corner posts) that stands out of the ground at least six to eight feet. This post gives the outdoor cat an escape route from pursuing coyotes. Coyotes can leap walls and fences of five to six feet fairly easily, but a coyote "roller" can be installed on the top of this structure to deter this.

Habitat Management

Coyotes can only eat refuse that is improperly stored or disposed of. High-quality garbage cans with tight-fitting lids will solve most problems. If coyotes are around, the cans should not be put out for collection until the

morning of scheduled pickup. Especially attractive food wastes, such as meat or leftover pet food, should be bagged; if scheduled garbage pickup is several days away, wastes should be frozen temporarily or hauled directly to a dumpster or other secure storage container. Intentional feeding of coyotes is inappropriate.

Aversive Conditioning

In adapting to the pace of human life in urban and suburban environments, coyotes may quickly come to realize that there are few real threats to them. Emboldened by this situation, they may be active by day or visit yards even when people are present. These bold coyotes should not be tolerated or gawked at, as is often the human response, but definitely given the message that they should not be so brazen. Shouting, chasing, banging pans, spraying them with garden hoses, or otherwise alarming them with our own bold actions will remind coyotes that humans are a threat and help educate these animals about the dos and don'ts of urban life.

Repellents

There are no repellents registered for use on coyotes. The aversive agents used for dogs and cats, however, might work to discourage these animals where any or all of these species are a problem.

A Last Word

In 1804 the Lewis and Clark expedition provided one of the first written descriptions of a human-coyote interaction. The explorers encountered a dog-like animal along the Missouri River, tried to kill it, and failed. Their interest was in scientific collection, but the coyote probably did not understand and likely would not have appreciated it any more than the many other reasons people used to bring about his demise. Many other attempts have followed, some successful, many not. Society's conflicts with coyotes have opened a window on humans as much as on the animals. Brute force and bitter feelings have become culturally institutionalized in parts of the country, spawning such sayings as, "The only good coyote is a dead coyote," and bumper stickers that read: "Eat lamb—one million coyotes can't be wrong." Clearly no good has come of the massive efforts to suppress this species—not for human beings, their economic interests, the environment, and certainly not for coyotes. Coyotes rebound against our attacks and return to their former numbers despite our most intensive efforts to eradicate them. That ability only heightens the feelings of antipathy some have toward them. A perpetual cycle of violence is created in the absence of any true understanding of the ease with which humans and coyotes can coexist. Like all cycles this one will be broken only by an applied force. Fortunately reason is a force, and we still have time to apply it before urban and suburban coyote problems develop legends of their own.

Resources

An informative and, for its time (first published in 1947), amazing work on the coyote is J. Frank Dobie's *The Voice of the Coyote* (University of Nebraska Press, 1961). Many more recent books and articles about these animals should be read as well. Among them are *Coyotes: Biology, Behavior, and Management*, edited by Marc Bekoff, and first printed in 1978, (the 2001 revision by Blackburn Press is a definitive, go-to source); Eugene Kinkead's "Coyote: The Species Indestructible," from his *Wildness Is All around Us* (E.P. Dutton, 1978); Hope Ryden's *God's Dog* (Coward McCann and Geoghegan, 1974), and Francois Leydet's *The Coyote: Defiant Songdog of the West* (Chronicle Books, 1977).



20

Crows

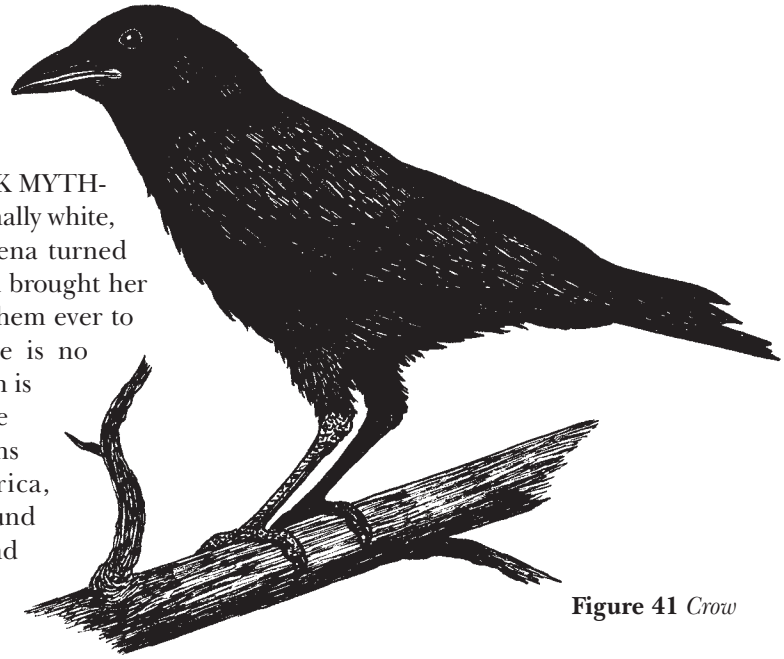


Figure 41 *Crow*

According to Greek mythology, crows were originally white, but the goddess Athena turned them black after one of them brought her bad news. She also forbade them ever to land at the Acropolis (there is no word on whether that sanction is still in effect, however). There are certainly no such sanctions in any city in North America, where these birds have found comfortable homes. This trend is relatively recent: crows began abandoning traditional roosting areas in the country for towns and cities in the 1950s. Now many crows commute to the country, passing over human beings going the other way. There they visit corn fields and pastures to forage by day before returning in late afternoon to urban roosts. Too often overlooked is the marvel of adaptation that crows represent: highly intelligent, perceptive, socially skilled, and ecologically adaptable representatives of their order (Figure 41).

- **Crows are year-round residents throughout the United States and some areas of southern Canada, and they are widely distributed throughout most of Canada in the summer.**
- **Seen in yards and along the streets, especially on trash collection day, large numbers of these birds sometimes roost in wooded urban areas over the winter.**
- **Crows use at least two dozen distinct vocalizations to communicate.**

Classification and Range

The American crow (*Corvus brachyrhynchos*) is one member of a large family of birds, the Corvidae. This group also includes many varieties of jays and magpies as well as the common raven (*C. corax*), which tends to inhabit more remote and wilder areas than its cousin the crow. The American crow is found across most of the United States all year long and in Canada in the summer. Its close relative, the fish crow (*C. ossifagus*), is found along the eastern seaboard, while the northwestern crow (*C. caurinus*) is found on the other side of the continent along the Pacific coast. Both of these are more specialized in their habitat preferences than the American crow. A fourth species, the Tamaluipas crow (*C. imparatus*), has made its way north into the United States from Mexico and is most commonly seen around the Brownsville, Texas, dump, which explains what all those people with binoculars are doing there.

Crows and West Nile Virus

Crows became associated with West Nile virus (WNV) when health authorities used them as an "indicator" species; asking the public to report dead crows to verify the presence of WNV. This left many people with the mistaken impression that crows cause WNV, which is not the case. Mosquitoes spread the disease, not crows: health authorities recommend controlling mosquito populations and avoiding mosquito bites to prevent WNV, not killing crows. While it is impossible to know the numbers of wild birds killed by this disease, crow populations in some areas seemed to have declined due to WNV. Once infected, very few crows survive—perhaps only about three in a hundred.

Habits

The American crow uses almost any combination of woodland, farmland, orchard, or suburban neighborhood, but its special affinity for agricultural and urban settings often leads to conflict with humans.

Crows are monogamous and mate for life, with last year's offspring often helping the breeding pair build the nest, feed the incubating female, and feed and tend the young. Crows start nest building in early spring and can often be seen carrying building materials of bark, branches, and twigs at that time. Nests can be anywhere in areas with blocks of trees; crows prefer conifers but will also use other trees. Usually four to six eggs are laid and incubated for about eighteen days. The young are tended in the nest until they are ready to fledge at about one month of age.

Public Health Concerns

The most important public health issue involving crows comes with the accumulation of fecal droppings at roosts and the potential, albeit very slight, risk of histoplasmosis.

Problems

Crows can damage agricultural or garden crops, pulling up seedlings, harvesting fruit, and eating grain crops such as corn. They occasionally bully smaller birds at feeders, although this is not a serious concern. Crows are sometimes predators on other birds' eggs and take a toll on nestlings. As opportunistic generalists, they will exploit trash when they can. This is perhaps the classic way in which they come into conflict with homeowners (Figure 42). Tens, hundreds, even thousands of these birds can occupy urban and suburban woodlots in winter, raising human anger over the noise and commotion they cause, which can be considerable.



Figure 42
If you put your trash out at the curb in plastic bags when crows are around, be sure to include some napkins, in case they would like to tidy themselves up after spreading trash all over your yard. THE HSUS

Solutions

Tolerance

As anyone who has raised an orphaned crow or studied this bird to any extent can attest to, crows have a high degree of what we would call intelligence, which may mean nothing more than that they are sociable and solve problems in ways a human being would. Most times when we encounter them in yards and around neighborhoods, they are not really causing problems. In such instances they should be left alone (and appreciated).

Exclusion

Keeping crows out of trash is fairly easy, as long as intact and secure trash receptacles with tight-fitting lids are used consistently. Trash bags placed alongside the curb or overfilled bins will invariably attract crows, who open the bags easily to retrieve what they want. Crows do this by day; trash scattered overnight is the work of others—dogs or, perhaps, raccoons—but may be blamed unjustly on the crows whom the homeowner sees in the morning eating the leftovers after the real culprits are gone. No matter who gets in the trash, simply putting lids on is enough to keep out crows.

Disruption of Roosts

Disbanding winter roosts requires a concerted effort and coordinated activities that should begin as soon as the main aggregation has formed, typically a few weeks into the roosting season. Pyrotechnics are a reliable standby, if they can be used. Pre-recorded distress calls, lasers, or fogging with methyl anthranilate repellent are all proven techniques that typically require professional deployment for maximum efficacy. Some researchers also suggest the relationship between outdoor lighting and winter roost sites deserves more attention. While this relationship is not proven yet, reducing outdoor lighting, directing lighting downward, or using other "dark sky" lighting techniques may make a site less attractive to crows and benefit night-flying species and people who want to enjoy views of the night sky. Trimming and thinning roost trees can also be very effective and should occur before the start of the roosting season.

Scare Devices

Visual scare devices can be effective in preventing crows from getting into gardens, as the very ancient concept of the scarecrow attests. These can be homemade and either effigies, like the scarecrow, or shiny, alarming, reflective, moving objects, such as suspended pie tins or Mylar® tape made especially to deter bird presence. All scare devices work better when used consistently and moved around so crows don't get too used to them.

Habitat Modification

While recognizing the value of mature trees in urban environments, thinning and pruning trees can reduce their use as winter roosts where significant conflicts exist. Better still is the dedication of woodlot space to roosting crows and adequate protection so they do not conflict with people and people do not conflict with them.

A Last Word

There are still people who think nothing of killing crows when they pose problems, even to the point of mass poisoning of the birds on winter roosts. The crows are the immediate victims of this, but many other species can be affected through indiscriminate poisoning.

Resources

A couple of good books on crows include Lawrence Kilham's *The American Crow and Common Raven* (Texas A&M University Press, 1989) and a more recent offering by John M. Marzluff and Tony Angell, *In the Company of Crows and Ravens* (Yale University Press, 2005).

A somewhat eclectic group of crow advocates and enthusiasts holds forth in anonymity at The American Society of Crows and Ravens (ASCAR): *www.ascaronline.org*.

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Deer



Figure 43 *White-tailed deer*

TODAY DEER ARE ONE OF the most easily recognized and frequently encountered wild animals in North America. Yesterday it was a something of a credit to one's woodland skills simply to get close enough for a fleeting glimpse. Like other species adjusting to city and suburb, deer now abound in many of the places where the densest human settlements occur, and some argue that they have expanded beyond acceptable limits, surpassing human tolerance, damaging yards and gardens, affecting natural plant communities in parks and reserves, and posing hazards on roads as collisions with vehicles become more frequent.

In consequence, much debate, controversy, and turmoil surround the issue of what to do about "too many deer." As generations of researchers labored over studies aimed at improving deer habitats and increasing the size of deer herds, few focused on the role and place of deer as members of ecological communities. Some with experience in looking at other herbivore-plant relationships predicted that things would sort themselves

- **In winter mule deer may form small herds of both sexes, but the usual social group includes a doe, her fawns, and her yearlings.**
- **Plant eaters? One study reports observing deer eating dead fish washed up on the lake shore. Perhaps this unusual behavior was caused by the fish's mineral content, perhaps it was just to scandalize the observer.**
- **The deer's hair is hollow, making it a superb insulator that protects the animal, even in brutal cold.**

out, vis-à-vis deer and forests. Others suggested ecological disasters of long standing. The jury is still out, and, in a sense, that discussion has less relevance for readers than what to do about deer browsing in the garden. That, we can offer some help with, even as traditional deer managers insist that the herds have to be "thinned" to correct the current situation. Not so.

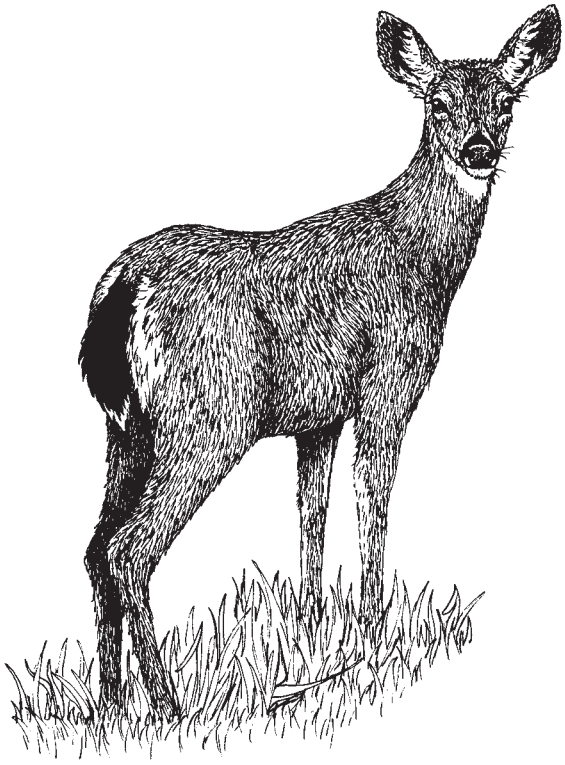


Figure 44 *Black-tailed deer*

Classification and Range

The term "deer" can apply to several different kinds of animals in North America, including such well-known species as moose, elk, and reindeer. The "deer" people typically think of belongs to the genus *Odocoileus*. Mule and black-tailed deer (*O. hemionus*) are restricted mostly to the middle to western parts of the continent, while white-tailed deer (*O. virginianus*) are found almost continent-wide, except for the northern tier of Canada and parts of the far west in the United States (Figures 43, 44). Deer are highly variable in size. The endangered Key deer of south Florida rarely exceed 60 pounds, while male deer in other states to the North can exceed more than 400 pounds.

Habits

Mule deer appear more tolerant of semiarid grasslands than the white-tailed deer, but both species occupy a wide variety of habitats. Deer traditionally are thought of as a woodland species, but they are actually ideally suited to exploiting "edge" habitat. Edges are created at natural or human-made habitat breaks, from woods to croplands or pasture, or from woods to marshlands. One area (the woods) provides cover and shelter, while the other (farmland, field, or backyard) provides food. In more northerly latitudes, deer may have summer and winter home ranges that can be as much as thirty miles apart. Where winter snows are significant, large numbers of deer congregate in "yards" under evergreen cover. Deer are faithful to home ranges, believed to be shared by related females who form matriarchies. Deer can be active at any time of day or night, but they are seen most commonly around sunset and sunrise, an activity pattern denoted by the term crepuscular.

Deer are primarily herbivores whose feeding habits and preferences vary widely from one location to another. Usually described as "browsers," they favor terminal branches on trees and shrubs, whose buds may be winter and spring forage and whose leaves summer foods. Fruits and seeds may also be consumed as they become available, and what is called "hard mast" (foods such as hickory nuts and acorns) is extremely important in fall and early winter diets, when deer are establishing fat reserves. Deer can be quite selective about certain foods and are known to favor heavily fertilized ornamental and garden plants above others that have not been as well fertilized (Figures 45, 47).

Deer breed from October to January, with the onset varying slightly in different geographic areas. This period, termed the rut, involves dramatic physiological and behavioral

changes in males. For example, the neck of a male in rut can swell to more than twice its normal size, in preparation for the serious antler-to-antler contests of strength that usually determine mating rights. Nervous and almost constantly active, males are often oblivious to vehicles and frequently are so driven by the urge to mate that they wander into places where they would never be seen otherwise. Gestation takes about two hundred days, with one to three fawns born in the spring. The number of fawns conceived depends in part on the nutritional condition of the does at the time of mating (Figures 46).

Public Health Concerns

Deer may be an important host for the ticks that carry Lyme disease; however, their role in contributing to the spread and prevalence of this disease is debated. Mice and other small mammals are important hosts of pre-adult ticks, and fluctuations in small mammal numbers are currently thought to be more important than deer numbers to Lyme disease prevalence in humans. Small-mammal numbers are often largely dependent on acorn production, so that, ultimately, oak trees may be the determining factor. It may be easy—and often convenient—to point to deer as the "cause" of Lyme disease when, in fact, the ecology of this wildlife disease is more complex than simply counting deer.



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Figure 45 *These daylilies are up and growing early in the spring and likely to be sampled by deer, along with other garden plants. The damage is slight and temporary, as deer focus their browsing on the woods nearby once they open up with spring growth.*

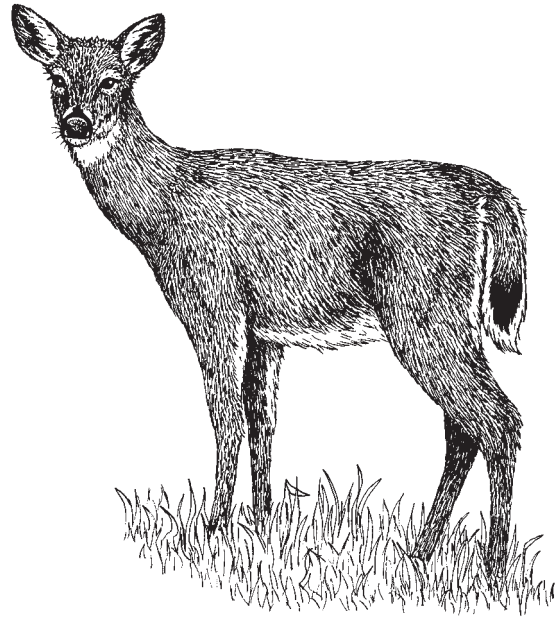


Figure 46 *White-tailed deer*

Problems

Deer damage to plants is usually not difficult to identify, as these large herbivores are capable of significant and widespread effects, especially on small gardens or formally landscaped areas. Where deer damage might be confused with rabbit or woodchuck damage, look for a ragged, square, torn appearance at the end of browsed twigs. Deer do not have upper incisors, so they do not clip-browse neatly, as do other species. Another fairly obvious sign that deer are at work is the height of browsing—three to five feet from the ground (or even higher where snow accumulates). Woodlands in areas heavily populated with deer may exhibit a "browse line" in which the vegetation will have a neatly trimmed appearance up to the height they can reach. The forest floor is denuded of vegetation or completely dominated by plants that deer do not eat, such as certain ferns. (The same situation may occur where cattle and other domestic livestock have been pastured for any length of time.)

Deer sometimes damage small elm trees by stripping their bark for food, but this is relatively rare. More frequently deer damage small trees when males rub their antlers along trunks to scrap off their velvet (the outer growth from hardening antlers), stripping the

trees of bark in the process. These "buck rubs" occur most frequently in the fall, just before the start of rut.

Solutions

Tolerance

One of the best ways to address current problems, as well as to look ahead to future coexistence with deer, is to encourage understanding of and a tolerance for these animals and the effect they sometimes have on resources that human beings seek to protect. This is not to say that all deer damage has to be accepted, only that it is inevitable that some will occur where deer and people share living space. Farmers seem to understand this, and a similar understanding may come to suburbia as well.

Plant Selection and Placement

Deer damage can be lessened considerably, and in some cases possibly eliminated, by thoughtful landscape design that gives care to the selection and placement of plants. Deer will eat some plants (hollies and barberries are good examples) only when succulent growth is appearing, if at all. Others (such as impatiens) are almost irresistible to deer all the time. More and more publications are appearing with lists of plants that are tolerant of, or even resistant to, deer browsing. We encourage homeowners to contact local nurseries, landscaping companies, or gardening clubs for advice, as well as neighbors, if they are just moving in to a new home. Deer feeding habits and preferences vary so widely, even within relatively small geographic areas, that the more local the advice you receive, the better.

An important factor in landscape planning is the actual browsing "pressure" deer are exerting. When damage is slight to moderate, a wider variety of plants can be grown and simpler strategies used. Under heavy browsing conditions, our recommendation is either to use deer-proof fencing or to limit plantings to those species that are the most resistant to deer browsing. To the extent that it is possible, we advise landscaping with native plant species that are know to be resistant to deer.


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Figure 47 *Ideal deer habitat is created when trees are cut down for farmland, which is then abandoned and goes through an explosive phase of secondary growth. This creates lots of food and provides cover for deer.*

Another key to minimizing deer problems is taking steps to deter deer before they cause damage. Seeing deer or signs of them (tracks and scats) around the yard can be a distinct warning to the homeowner to be alert to early signs of browse. It is when browse first starts that it is easiest to control. Young plants set out in spring can be very susceptible to damage because wild vegetation has not yet "greened up," and the garden plants, with their new growth, are especially attractive and palatable. Later, as their growth hardens and alternate foods become available in field and woods, deer may naturally shift away from the yard. Plant covers and protective netting can provide good protection at these times.

Fencing

Where deer are a serious and chronic problem, the most effective and permanent way to protect crops or landscape plants is with fencing. Over the long term, no other method, whether it involves lethal or non-

Elk and Moose

Elk and moose are the heavyweights of the North American ungulate division. Elk (Cervus elaphus) *are found throughout much of the west; the moose's* (Alces alces) *distribution is more northerly, but it is more even throughout available habitat than is the elk's. Moose range from New England, north through all of Canada, and into Alaska. In the west, they range as far south as Idaho. Moose can stand up to six feet tall at the shoulders and weigh a thousand pounds or more, while the elk, at less than half that weight, still remains a formidably large animal. The most serious conflicts with either of these animals are collisions with vehicles. As dangerous as deer-vehicle collisions are, the greater size of elk and moose make such encounters even more so.*

lethal means, will be as effective. A variety of fence designs have been developed, ranging from high-tensile strand wired to solid posts to woven mesh chain link or various types of electric wiring. The best type for any given area depends on the situation, and local extension agents or wildlife specialists should be consulted before any expense is incurred. Where deer have other forage available, simple fences can sometimes keep them out of yards and gardens. However, when they are stressed for food, they may jump fences up to ten feet in height.

Electric fences can be highly effective in deterring deer, and the simplest and least expensive of these are single-strand fences that work on the unusual principle of attracting rather than repelling the animals (Figure 48). Deer are large and well insulated, thanks to their dense hair coats and poorly conducting hooves. Where they might just walk through a single strand of electric fencing, they can be enticed with a scented "bait" to approach the fence and contact it with nose or tongue, ensuring that a much more objective lesson is delivered via these more sensitive parts of the body. Aluminum foil with a dab of peanut butter or cups (actually metal bottle caps) wired to the fence with cotton fillers impregnated with apple or other fruit scents have proven quite effective in keeping deer out of small gardens.

Tree Protection

"Buck rubs" can be prevented by wrapping trees with any commercial product sold for that purpose or placing corrugated plastic sleeves around them. Perhaps even simpler



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Figure 48 *This garden is protected from deer by a simple one-strand electric fence. The deer are lured in to investigate the fence by an attractant placed at intervals along the wire. They get a shock when their tongue or nose touches this and a lasting memory of an unpleasant experience that keeps them away from the vegetables (see Figure 17, which illustrates how this fence is baited).*

is erecting a temporary fence surrounding vulnerable trees (usually smaller, two- to three-inch-diameter trees that stand alone) or surrounding them with two-inch garden stakes that deflect any rubbing.

Repellents

A variety of products (including some homemade remedies) can repel deer. The key to using any repellent is to begin applying it as soon as you see the first signs of damage. Deer are extremely wary animals who will avoid places in which they feel threatened or insecure. If the gardener immediately launches a concerted effort to repel these animals when the first signs of their presence appear (tracks or early browse), success is more likely. Home remedies, such as soap, hair, and garlic, have traditionally been used in smaller gardens and orchards. Some gardeners have noticed that products such as fish emulsion fertilizer and insecticidal soaps, applied as a foliar spray, can have repellent properties, even though they are not labeled or sold for that purpose.

Scare Devices

Scarecrows and effigies may repel deer under limited circumstances, especially if the effigies move so they appear threatening. Lights, sprinklers, and noisy alarms on motion sensors may help protect gardens, or at least alert the homeowner to the presence of something outside that should be checked. Scare tape or balloons may also be effective in frightening deer. The key to using scare devices is to couple them with other strategies and to vary them, moving them around or changing the place from which the frightening stimulus comes (when this can be done).

Collision-Avoidance Devices

Deer-vehicle collisions have become a much greater concern in the past few years, as new roads are built through deer habitat, deer populations increase, and deer move increasingly into suburban areas. Strategies to deal with this issue must occur at the community level and be imitated through cooperative work with transportation agencies. For some years experiments with roadside reflectors have taken place in communities across the country, and even more sophisticated technology that allows sensors to pick up possible animal movement near roads and warn oncoming drivers is now being tested (Figure 49). These technologies have their detractors, but so did the first automobiles when they were being developed. Time will tell whether any of them is truly successful.

One opinion we can render now, however, relates to deer warning whistles mounted on a car's hood or bumper. As for ultrasonic devices, no information exists at this time to suggest they work. What may be true about them, though, is that people who go to the trouble to mount them on the car are likely to be more alert to the possibility of deer on roadways, and their attentiveness might reduce the chances of their colliding with deer.

Orphaned or Kidnapped?

Every year people call wildlife agencies and wildlife rehabilitators about "orphaned" fawns they stumbled across in woods, fields, backyards, or roadsides. Worse, agencies and rehabilitators often face a concerned individual at their door with the animal in his arms! It is perfectly natural in the spring to come across a deer fawn by herself in the woods. The fawn is actually not alone; her mother is nearby, aware, and attentive. The strategy deer have evolved to deal with their primary predators (which once were wolf and bear) is to leave their young hidden except when feeding them. If anyone encounters a fawn like this, leave her alone, with the assurance that a solicitous and anxious mother is nearby and will take care of her once you move off.


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Figure 49 *The roadside reflector (Streiter-Lite®) reflects headlights as a series of light beams (an "optical fence") to keep deer from crossing in the path of oncoming vehicles. This and other technologies to help prevent deer-vehicle accidents are important in addressing this growing issue.*

Dogs

Some commercial nurseries, as well as homeowners, have reported that dogs ranging at large keep deer away, while the dogs are kept from straying behind an "invisible" fence. We have concerns for dogs when owners rely on these fences and serious problems with letting dogs run at large and be off leash in other circumstances. There is little doubt, however, that deer acknowledge dogs as antagonists and avoid areas where they are active. With this in mind, having a dog "mark" your yard as her territory may deter deer. The dog will want to do this anyway, and it may mean nothing more than a routine walk around the yard before setting out onto neighborhood sidewalks. It also costs nothing, unless you have a budget that actually takes into account the amount of water your dog might be consuming each day. The message can be reinforced by scattering the hair your dog donates as you groom her around property boundaries.

A Last Word

One thing we have neglected to mention about deer is that they are big business in North America. Many millions of dollars are spent every year on deer hunting, as deer are by far the most popular game animal in the United States. During difficult economic times, state wildlife agencies become increasingly dependent on the income generated from deer licenses and the federal monies that come to them from taxes on certain sporting goods. Their focus, understandably, is on how much income these animals can provide to *them*. Everything from research to managing conflicts with deer is influenced by this reality, making all decisions about how to manage deer aptly describable as biopolitical.

We must comment on the claimed "problem" of deer becoming so tame that they do not flee on seeing human beings and often appear quite bold in standing and staring at such fellow travelers as they hike by. Enjoy these moments and take the time to look back. What you see will be pleasing to the mind as well as the eye.

Resources

There are many popular books and websites that provide information on deer. A technical paper that we recommend is Allen Rutberg's chapter "The Science of Deer Management: An Animal Welfare Perspective," in *The Science of Deer Management* (Smithsonian Institution Press, 1997). Copies can be requested directly from the Wildlife and Habitat section of The HSUS (2l00 L Street, NW, Washington, DC 20037).

We recommend *www.mydeergarden.com* among websites, of which there are many.

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Foxes

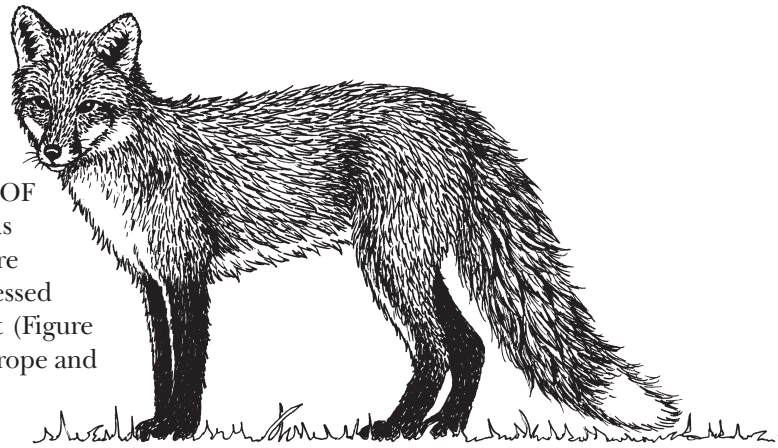


Figure 50 *Red fox*

WHAT SPECIES OF urban wildlife has been studied more than any other? If you guessed the red fox, you are right (Figure 50). Thanks to work in Europe and Great Britain, there is a body of research publications, ranging from population and behavioral studies to reviews of injury and disease, devoted exclusively to urban foxes. The research expands on what anyone who has observed or read about foxes already knows: these are fascinating animals who combine many of the behavioral and ecological traits of cats with their obvious membership in the dog family—enough so that the red fox is often called the "cat-like canine."

To many people, the fox is the animal they least expect to see in the city. In fact, foxes are well adapted to urban life, being (like most other successful urban mammals) generalists who use a wide range of habitats, exploit a wide range of natural and human-produced foods, and alter their activity schedules, if necessary, to be primarily active when humans are not. The reward for this is a longer life than their rural counterparts and a death that is more likely to come from disease or accident than by predation, hunting, or trapping.

- **The red fox is the most widely distributed wild canid in the world.**
- **Foxes occasionally make dens under decks, patios, or outbuildings.**
- **They visit gardens and yards, sometimes to hunt, sometimes to get from one place to another, sometimes just because they are there.**

Classification and Range

There are three genera and six species of foxes in North America, but only three—the red (*Vulpes vulpes*), gray (*Urocyon cinereoargentus*), and kit (*Vulpes macrotis*) fox—are town or city dwellers. The last is of quite some interest: it is an endangered subspecies in California found in towns (Bakersfield, for example) and a rare case in which urbanization may be helping an endangered species survive. (Coyotes are the primary cause of mortality in this smaller canid, and the urban setting may inhibit these predators' presence.)

While red foxes are native to North America, at least some of the populations in the United States are descended from animals imported by European colonists, seeking to transfer the pastime of fox hunting with hounds from the Old World to the New. Other red foxes may have come to North America by the same Ice Age land bridge that the first humans used, complicating the picture of which populations are truly "native." The species origins wouldn't matter to anyone but specialists if the distinction between foxes as native or alien were not used as an excuse to persecute them in some places.



Figure 51 *Gray fox*

Foxes are not large animals, although their relatively long legs and bodies elongated by bushy tails make them appear to be. The red fox is the bigger species, weighing seven to fifteen pounds, with a body of about two feet in length attached to a twelve- to eighteen-inch tail. Grays tend to be smaller than reds, but there is considerable overlap in size between them (Figure 51). Kit foxes are markedly smaller than either gray or red foxes. Because color varies greatly among foxes, a red-colored fox is not necessarily a "red fox" or a gray-colored fox a "gray." When you can get close enough to see it, a white tip at the end of the tail indicates a red fox.

Habits

Both red and gray foxes prefer diverse habitats that have fields, woods, shrubby cover, farmland, or other variety. Gray foxes are more dependent, apparently, on woodlands than are red, and they sometimes even climb trees when the mood strikes or need demands. Both species readily use urban and suburban parklands, golf courses, and developed areas when they can find enough privacy.

Foxes are primarily nocturnal in urban areas, but this seems an accommodation to avoiding humans rather than a preference. If you do see a fox out and about by day, it doesn't necessarily mean the fox is ill. Foxes are active by day as long as they feel secure, and if they are pursuing prey that is active by day, such as squirrels.

Foxes, like many other wildlife species that successfully exploit urban environments, are dietary generalists who can survive on a wide variety of plant and animal matter. Although far more frequent and capable hunters than are many other urban wildlife species, such as raccoons, when certain fruits are abundant, foxes will not hesitate to go vegetarian. One reason they are described as cat-like is that foxes hunt more by stealth than by the pursuit tactics typical of canids. A hunting red fox is all ears, literally, as he seeks the faint rustling sounds made by his prey, stalking closely and launching a long, graceful,

leaping pounce at the moment he feels he has locked onto his target.

Kits, as the young are called, are born in the spring, usually in March or April. Litters may be as large as eight, but average four or five kits (Figure 52). Once they are about six weeks of age, fox kits can survive the loss of their mother, since their father and even other group members (last year's kits grown up, but still with the family) will keep feeding them. (Alloparenting is the term for the care given by such nonbreeding male or female foxes.) The kits are weaned by nine weeks and begin to hunt with their parents. They may stay on after that or, under some circumstance, leave (or disperse, as it termed) in late summer or early fall to establish their own territories.

Both red and gray foxes may dig their own dens, or they may occupy the abandoned dens of woodchuck, badger, or other burrowing animals. Dens are used mostly as an escape from severe winter weather or for raising kits. Even when winter weather is uncomfortable to humans, foxes often rest under brush piles or fallen logs and may be covered by snow as they wrap their bushy tails around their bodies.

Public Health Concerns

Foxes are the primary carrier of one of the major strains of rabies that infects foxes as well as other animal species. In some parts of the country, foxes carry the echinococcosis tapeworm, which can cause a serious and sometimes fatal disease in humans. Sarcoptic manage is a very serious problem in some fox populations, but it is not a health concern for humans.

Problems

People may be surprised and sometimes frightened to discover that foxes live in their neighborhoods, but these fears are almost completely groundless. Foxes are not dangerous to humans, except when they are rabid (which is very rare) or are captured and handled. Even then, it takes a lot of handling for a fox even to defend himself by biting, and the natural tendency is for the animal to flee rather than fight. Red foxes occasionally prey on small house cats or kittens and certainly will take small animals such as rabbits, guinea pigs, and poultry when they are left outside unprotected. Both red and gray foxes will eat cultivated grapes, raspberries, and other fruit, but they usually do not bother garden vegetables. In all, foxes do such little damage and cause so few conflicts with people that we hesitate to characterize them as a problem at all. Nonetheless, thousands are killed every year because they are perceived as threats.



JOHN HARRISON

Figure 52 *For many people seeing a wild animal like a fox is a real thrill. With a little patience and care, you can experience that and more in the spring when kits are old enough to come out of the den and begin to explore the world around them.*

Solutions

Tolerance

Sometimes foxes are blamed for damage they did not cause. The trash can that was knocked over by the neighborhood dogs may attract a fox who is observed and then blamed. Foxes may cut through yards when moving from one hunting area to another, and the homeowner becomes unreasonably concerned about their presence. In fact, the fox is not a bother at all. If left alone, he will probably do the homeowner a service by performing a little free rodent control as he passes by.

Exclusion

Poultry should be protected with secure hutches or pens built to withstand any effort by foxes, raccoons, or dogs to break in. Because predators can dig under fences, it is important to make sure that an L-shaped footer is buried around the outer perimeter. Electric fences can also exclude foxes but work best in conjunction with other permanent perimeter fencing, as when a single-strand electrified fence is placed about four inches off the ground in front of a chain link or other fence. For their health and safety, The HSUS recommends that pets such as rabbits and guinea pigs not be kept outdoors, especially at night. If outside by day, they should be housed in structures that are secure from both bird and mammal predators.

Repellents

No repellents are registered expressly for use on foxes, although the many products sold to repel domestic dogs from yards and gardens undoubtedly will have a similar effect on a passing fox.

Scare Devices

Because foxes are active mostly by night and are very cautious about people when out and about, suburbanites rarely see them. Noise-making devices, ranging from transistor radios to motion-sensitive alarms, can be quite effective in combining repelling and harassing strategies. A motion-activated sprinkler can be an effective deterrent in lawns or gardens. Even using a loud voice or banging on a pot or pan can frighten these very sensitive animals and keep them out of an area where they are not wanted. They retreat at any sound or sight that is the least bit threatening.

Harassment

Fox dens under porches and decks are one of the most commonly reported issues with these animals. As with all instances of any wild animal denning or nesting in an inconvenient spot, we recommend tolerating the family until the young are old enough to follow the parents on nightly forays and the family moves on. When they are gone, exclude them from reusing the den. Fox kits will spend time playing outside the den just before they are able to go out with their parents, making this one of the most enjoyable wildlife viewing experiences people can have.

Still, some people will want the family to move sooner rather than later. In these cases, mild harassment may encourage a move.

The Bold Fox

Sometimes red foxes will exhibit a brazenness that is so overt it is disconcerting. A hiker along a woodland trail may encounter a fox who does not retreat but rather sits and watches the human approach. Likewise, a homeowner hanging laundry may watch a fox walk through the yard, going about her business, seemingly oblivious to the human nearby. Why this occurs is any human's guess, and the foxes aren't telling.

Do Foxes Eat Cats?

People are frequently concerned about their pets being outdoors when foxes are around. The best way to avoid encounters between foxes and cats is to keep the cats indoors. By and large, however, foxes seem to pay little heed to adult cats, recognizing that they are dealing with an animal often almost their same size, with a well-deserved reputation for self-defense. Kittens, however, could be easy prey for a fox, as might small adult cats.

Start by placing objects, leaves, soil, or mulch in the den openings to disturb the residents. Used kitty litter or almost anything with a strong human scent will also alarm the foxes. Try a pair of smelly sweat socks or old sneakers placed in or near the den opening. People claim success in getting fox families to move simply by mounting Mylar® balloons two to three feet off the ground, just outside the entrance to the den. In all of these strategies, the idea is to make the parents uncomfortable and get them to move the litter to a more secure location. After that has taken place, make sure all the kits are out of the den before permanently excluding them.

Habitat Management

Food lures foxes into suburban yards. Attractants such as meat scraps should never be composted, and trash should be stored securely or placed outside only on the morning of collection. Don't leave pet food outside and never deliberately feed wild animals such as foxes, advice with which our friends across the Atlantic would disagree. In Britain, foxes are not only welcomed when establishing dens under sheds in backyards but are also fed regularly and systematically to make sure they feel accepted and appreciated. Here we discourage this practice, no matter how benign it may seem, because the fox that is used to getting handouts in one yard may be perceived as a threat in another, and treated accordingly, sometimes with lethal results.

A Last Word

For all the many studies that have been conducted on urban foxes, many more have been conducted in rural areas, and are few compared to the number devoted to animals such as deer, bears, and even quail. Game species (those that are hunted and trapped) have always received more emphasis in our society than have nongame animals. A slow change is occurring, as people have become increasingly aware of the importance of all species of wildlife and of the need, as conservationists have said repeatedly, to preserve the whole and not just the parts.

Resources

Where they have been best studied, in the United Kingdom, Stephen Harris's *Urban Foxes* (Whittet Books, 1994) summarizes many years of fascinating natural history. A more personalized account is David MacDonald's *Running with the Fox* (Facts on File, 1987), which describes a graduate career focused on these animals.

The Fox Project in the United Kingdom has information on deterrence and other natural history facts about foxes:

www.thefoxproject.org.uk.

23

Mice

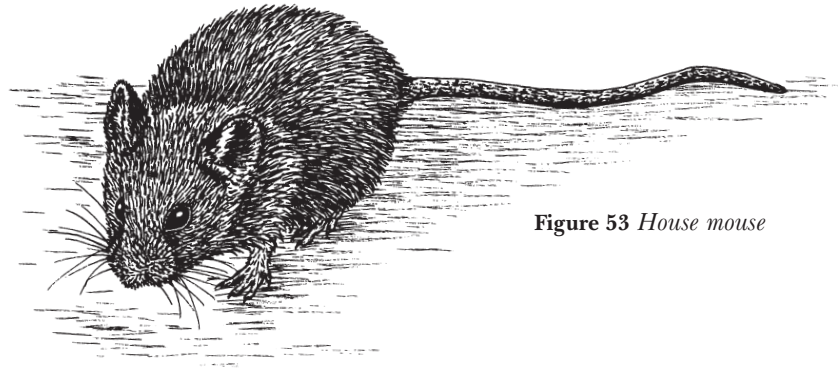


Figure 53 *House mouse*

For an animal who usually weighs less than an ounce and eats about one-tenth of its weight in food each day, the house mouse has caused problems throughout human history all out of proportion to its size (Figure 53). Adapted to a diet of seeds and grain, mice were swept right up to humanity's front door when the agricultural revolution swept through Europe and central Asia more than ten thousand years ago. So intimate became the association that today house mice and their larger cousins, the Norway and roof rats, are described as "commensal" rodents—they literally "share the table" with us.

House mice accompanied the first Europeans to the New World and have since become established almost continent-wide. They are most common around homes, farms, factories, and commercial buildings. Research in England, however, has suggested that wild house mouse populations may fluctuate seasonally, going extinct in the winter and rebuilding in other months as the overflow from human buildings spreads out into the fields and surrounding woods. At any rate

- **A house mouse will rarely wander more than fifty feet from her home area, which over a lifetime may be no larger than an average living room.**
- **When feeling threatened, a mouse can run up to eight miles per hour and squeeze through a passage less than half an inch wide to escape.**
- **In England, mice have been found living eighteen hundred feet below ground in coal mines; many mouse colonies live and grow in warehouses and cold storage areas that never get warmer than 24 degrees F.**

house mice can live in wooded areas, but they are most common in and around human habitations.

Classification and Range

The house mouse (*Mus musculus*) is just about what you'd expect a mouse to be—small (two to three inches long), gray-brown, with an almost naked tail as long as (or longer than) the body. The native range of *M. musculus* was Eurasia, but it is currently found worldwide wherever humans have lived or do currently reside.

House mice are one of a variety of animals called "mice" and are often confused with native North American species, such as white-footed and deer mice (*Peromyscus spp.*), harvest mice (*Reithrodontomys spp.*), or voles (*Microtus spp.*, *Clethrionomys spp.*) (Figure 54). Native mice often cause problems for which house mice are blamed, although the majority of techniques to prevent mice from invading one's house apply equally to all of these animals.

Habits

House mice prefer to live inside buildings, whether apartment complexes, single-family homes, granaries, barns, sheds, warehouses, offices, or any other type of man-made structure. The entire area occupied by a mouse during her lifetime may be less than the size of an average room. Much of her life is spent in secure, comfortable niches between walls and behind cabinets and appliances. The only evidence of her existence may be gnawed food packaging and droppings—in drawers, on floors, shelves, countertops, and every place else she can reach. Outside of human habitations, house mice live in rock crevices or in underground burrows that consist of a network of tunnels.

Mice are omnivores and eat a variety of foods, preferring seeds, grains, and nuts. They require only about one tenth of an ounce of food each day and, unlike rats, can live without access to fresh water if the solid food they eat is somewhat moist.

House mice breed year-round and can raise eight litters or more annually. Reproductive life begins for females at six to eight weeks of age. With an average of four to seven young per litter, the reproductive potential of these animals is considerable. Under the right conditions, mouse populations can grow almost explosively. This potential is counterbalanced only partially by their short life spans. One year is about the longest any wild house mouse can expect to survive.

Public Health Concerns

Mice, like their larger cousins the Norway and roof rats, can carry a wide variety of diseases transmissible to humans. Hantavirus, an important public health concern, occurs in both wild and house mice. Salmonellosis can be transmitted by mice and is an important concern in food storage and preparation areas. Mice can transmit bubonic plague through their fleas, as can Old World rats, and the native white-footed mouse is an important host to the tick that causes Lyme disease.

Problems

When mice are present in large numbers, they can and will consume considerable quantities of stored seed and grains. However, the quantities of food consumed will be much less than those contaminated with urine and feces. By gnawing wood, paper, cloth, books, and insulation on wiring, mice can also cause considerable property damage. You can see this type of damage if you look closely: paired tooth marks about one-eighth-inch wide. Nests may be found in hidden places, such as little-used drawers or cabinets, and are made from loose assemblies of paper, cloth, twine and other material. Droppings are rod-shaped, about one-third to one-quarter inch long and one of the best indicators of mice. Cats and dogs in the household may also alert people to mice by showing intense interest in otherwise bare walls, closets, or the area behind appliances.

Solutions

Tolerance

Sometimes people don't even know they have mice and live for years with a self-regulating population. Sometimes they know the mice are there but are indifferent to, or tolerant of, their presence. And sometimes the discovery of a mouse is regarded as a crisis requiring immediate disposal of the animals.

Native white-footed and deer mice move into buildings during the early fall or winter as part of their eternal search for safe refuge. Usually these animals can be humanely live-trapped and put back where they came from—the outdoors. House mice would probably not do well if evicted, but given the alternative, many homeowners are willing to try. If the mouse or mice can be moved to a protected outbuilding, their chances of survival increase. With any mouse problem, it is important to recognize signs of mouse presence early, identify the source of food that attracts them, remove it and the mice and, after the mice are gone, keep others from gaining entry to the house.

Exclusion

Mice can enter buildings through openings no larger than the size of a dime and can easily climb inside walls using the studs and wiring to make their way. Excluding them can sometimes be very difficult and must be seen as an ongoing and long-term effort. Nonetheless, exclusion is the best and only effective way to deal with mouse problems permanently. The key to excluding mice from buildings is to examine very thoroughly all possible points of entry around foundations: where utility pipes and wires pass into the house, where siding has deteriorated and holes occur, cracks in foundations, or any other places where an entryway might be suspected. Powder (such as baby powder, talc, or even flour) sprinkled lightly along the inside perimeters of walls and thresholds will show tracks where mice are active and can be instrumental in helping to decide where exclusion efforts are needed. This exclusion work

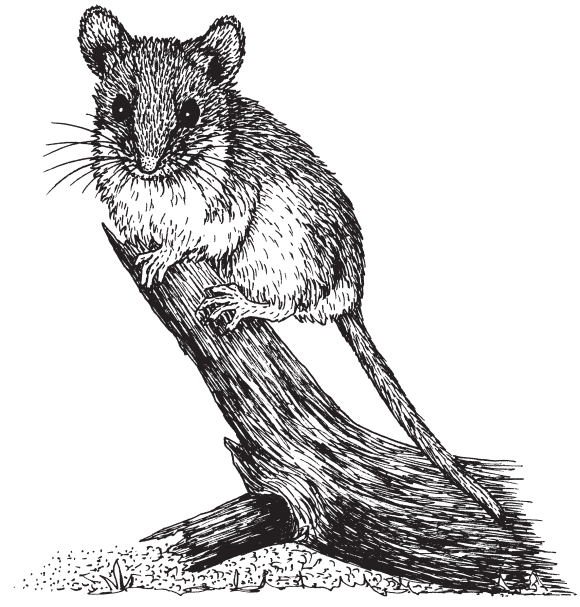


Figure 54 *White-footed mouse*

nicely complements the seasonal chore of checking and sealing a house that is done for good summer or winter insulation.

Many different materials can be used to exclude mice from buildings. Wire mesh or quick-drying cement can plug cracks around drainpipes and small openings where mice may gain access. Galvanized window screening can be balled and stuffed into larger openings that are then finished with caulking or cement. The best material for sealing openings that are not associated with electrical wiring is copper mesh. The expanding-foam insulation sold in many hardware stores is excellent for filling small- to medium-size openings and has the advantage of being available in commercial kits for larger jobs. Avoid caulking or other rubber or plastic fillers; mice can chew through these substances easily.

Habitat Modification

Thorough housekeeping to deny mice food is essential. Because mice eat so little, you must pay attention to both obvious and not-so-obvious sources. A small amount of spillage from birdseed stored in a garage or shed can be more than enough to sustain a mouse. Dry pet food left in the garage overnight or next to an appliance where mice can move behind

its cover is a bonanza. Mice also enjoy the security appliances offer on foraging trips into the kitchen to pick up the tiny amounts of spilled food that make a meal.

Food that is stored in cupboards, drawers, or cabinets should be removed and discarded at the first sign that mice have begun to use it. Thereafter these foods should be stored in metal or glass containers until the point of access can be found and blocked. Where possible outdoor protective cover can be eliminated by trimming a vegetation-free perimeter for at least eighteen inches out from the foundation of the house or building to be protected. This procedure allows better recognition of entry points as well.

Ultrasonic Devices

There remains no credible evidence that any ultrasonic device, no matter how much or little one is willing to spend, works to repel mice. We do not recommend these devices.

Live-Trapping

For those who wish to use live traps, there are different kinds of these devices widely available at grocery and hardware stores, or from retailers on the Web. A mouse who comes from generations of mice born and sheltered indoors is not likely to fare well if forced outdoors. Therefore, there are concerns for the welfare of these animals when trapped indoors and released outside. Ethical issues could be raised about their release in suitable (to house mice) habitat, which would be in the vicinity of human-built structures. There is every reason to believe that the chances of survival for a live-trapped indoor mouse upon outdoor relocation will be very low, and that should be understood up front.

Lethal Control

Undoubtedly, many more commensal rodents are killed annually than any other wild mammal. Usually this method must be repeated again and again as the rodent population rebounds. To a large extent, this can be mitigated and perhaps even avoided through early recognition and response. Unfortunately, lethal control often occurs because prevention was not considered, and killing is often not followed by the habitat management, sanitation, and exclusion that will provide long-term relief. In our view, *lethal control can never be justified without diligent efforts to apply other controls to prevent problems from recurring*.

We condemn the use of poisons (rodenticides) and glue boards to kill mice; both are less humane than the use of standard killing (snap) traps or the traps that use electricity to kill rodents (stunning or zapper traps). Considering the arsenal of lethal weapons human beings use in rodent control, there are no truly humane ways to kill mice, only some that are less inhumane.

A Last Word

Human beings' conflict with mice may be the most ancient of all engagements with animals, excluding the pursuit of prey for food or the flight from those who preyed on them. Once humanity chose a settled agrarian lifestyle, mice moved in and flourished off its messy households. If it were only a matter of mice eating their share of our foodstuffs, people could probably coexist with many millions of them and not feel any effect. But by contaminating so much more than they eat and by serving as a source or carrier of diseases that endanger humans, mice are clearly at odds with humanity. The key to managing conflicts with them is better habitat management, eliminating food sources and entry points into homes, and working to make the environment less attractive and available to these front-runners for the title of most successful mammal.

Resources

Books on how to kill mice abound, but for such an economically important and socially relevant animal, there are almost no studies of naturalistic behavior and life history from the perspective of pure interest in the animal for and of itself. Strange, isn't it?

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Moles

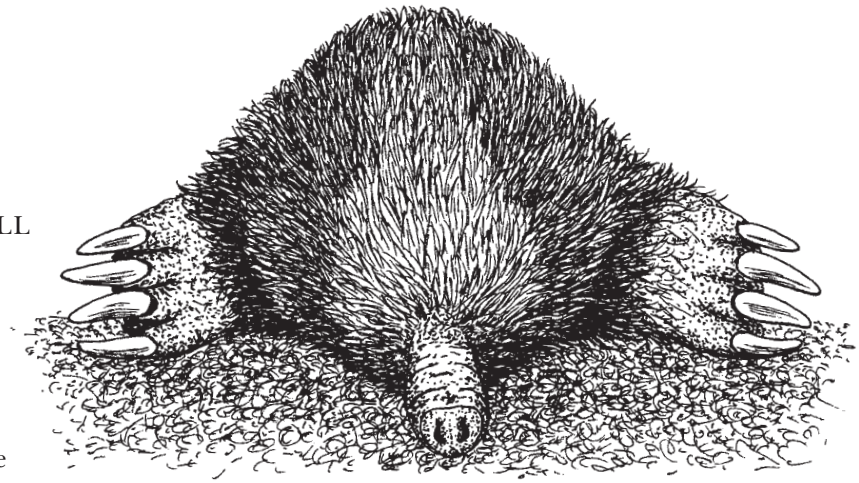


Figure 55 *Mole*

VIRTUALLY ALL of the conflicts that exist between people and moles today are over the effects these diminutive creatures have on the debatable aesthetic qualities of lawns (Figure 55). The lawn (first appearing in the English language around 1550, with the modern concept arriving with use in the mid-1700s), is an immaculate, meticulously maintained, weedless monoculture of grass. It is to many a sacrosanct representation of an ideal natural world.

Acknowledging that such landscaping must strike a highly resonant cord in humanity, we must pause still to consider its costs. Lawn maintenance requires phenomenal amounts of water, fertilizer, herbicides, and pesticides that have known toxic effects on birds and other animals, not to mention the environmental effects of runoff. Every acre of these landscapes, of course, could be an acre of forest or other habitat with much greater value to both wildlife and people. But Americans still commit vast land areas in new developments to this type of landscape, to the apparent satisfaction of many landowners and probably all moles.

- **As moles tunnel and turn soil, they mix and aerate it, improving conditions for plants.**
- **Moles can dig surface tunnels at a rate of almost twenty feet an hour and move through an existing tunnel at up to eighty feet a minute.**
- **The nose of a star-nosed mole is a touch organ; less than half an inch across, the star has more than a hundred thousand nerve fibers, providing the mole with six times the sensitivity of an entire human hand.**

Moles cause a visual impact to lawns by tunneling and pushing up mounds of earth. They provide environmental benefits by turning soil, mixing soil nutrients, and improving soil aeration. The mechanical damage they do, however, is simply not tolerated by many homeowners, and a cottage industry has sprung up to advocate, and often profit from, a variety of homemade "remedies" to solve mole problems. The result has been the invention of wildly imaginative devices to kill moles in their tunnels, many of which are reminiscent of the best in medieval torture devices. There are companies that practice full-time mole control and homeowners who pay them for these services.

Classification and Range

Moles are not rodents, although they are often mistaken as such. They belong to their own family (*Talpidae*) and are insectivores—meaning they eat worms, grubs, and other invertebrates found beneath the surface of the ground. Moles have small eyes and ears often hidden in fur, naked snouts, and large, paddle-shaped forelegs that clearly distinguish them from mice. Seven species of moles live in North America, the eastern (*Scalopus aquaticus*) and star-nosed (*Condylura cristata*) moles being the most widely distributed. Moles do not occur in the Rocky Mountains or the desert southwest.

Habits

Moles are fossorial, meaning they spend most of their lives underground, and rarely make an appearance on the surface. They prefer moist loose soils for easy tunneling and generally avoid rocky soils and clay.

Moles predominantly eat earthworms. They also consume a wide variety of other invertebrates, including snails, centipedes, spiders, and insects, especially grubs (the larval form of beetles). They also eat vegetation and the occasional baby mouse when a nest is encountered.

Breeding occurs in late winter and early spring, and litter size usually ranges from three to seven. Nests are made of grasses and other vegetation. The young, born in a deeper burrow than the foraging tunnels normally seen on the surface, are independent at about four weeks of age. The tunnel systems are complex matrices of runways and nesting areas that create their own micro-habitat that may extend over a half-acre. In this subterranean environment, away from the cycle of day and night, moles may be highly faithful to activity routines that break time into four-hour segments of sleep followed by activity.

Public Health Concerns

Moles are not considered to be a source of any infectious disease that can be transmitted to humans.

Problems

On golf courses and lawns, the evidence of moles is frequently their excavations, either small mounds of earth (molehills) pushed up from deep tunneling or shallow surface tunnels (runs) that collapse underfoot and may leave dead patches in lawns (Figure 56). When mower blades hit the raised turf over mole runs, the damage can be evident.

Solutions

Tolerance

Because moles feed underground, it stands to reason that some of their diet is insects that can be harmful to lawns. How much they help the homeowner with grub control is not known. When moles are abundant and perceived to be a problem, invertebrates are likely to be abundant as well, and removing moles may leave the homeowner with an insect problem. As a result direct efforts to control moles or their habitat are not necessary except in extreme cases. If they do become necessary, use habitat management and exclusion.



THE HSUS

Figure 56 *Many homeowners would not tolerate this mole "damage" to the yard. This one did, and the lawn recovered quickly with a little attention and replacement of divots. The mole population, high this year, was low the next, and there was no evidence of mole presence then. Sometimes not doing anything is a sound management strategy.*

Habitat Management

Problems with mole tunnels are usually mechanical damage from a lawnmower hitting the raised mounds of earth. This can be avoided by simply flattening the mole runs with a foot or with a lawn roller before mowing. Overwatering lawns can keep earthworms and other mole prey near the surface, resulting in moles tunneling near the surface. Naturalizing lawns by withdrawing artificial fertilizer and water that is needed to support moncultures of carpet-like grass is encouraged for its own beneficial purposes, but also to aid in creating a landscape more tolerant of mole presence.

Exclusion

You can keep moles away from flower or garden plots by burying hardware cloth (one-fourth-inch mesh) in the recommended L-shaped footer configuration or installing a commercial L-shaped footer, but the effort and expense this requires does not permit us to recommend it. Barriers to keep weeds from spreading into flowers beds, such as a concrete edge, may also repel tunneling moles if buried eight to twelve inches underground. But, unless you inherit these from a rich uncle, the costs involved may be prohibitive. Exclusion is recommended only for exceptional situations or if the homeowner has reasons other than moles to practice it.

Repellents

The castor bean or castor-oil plant (*Ricinus communis*) is often recommended as a mole repellent, but further research to document when and to what extent it is effective seems warranted. There are commercially available repellents made from an extract of the plant. Consult your local garden center for availability as well as advice about effectiveness. Unthinking people put all sorts of things into mole tunnels to discourage these animals, ranging from mothballs to gasoline to cocoa-flavored glue. These are all ill advised, if not inappropriate, as well as inhumane and environmentally damaging. The fact that in all likelihood they do not work should be taken into consideration as well.

Scare Devices

Some people report that garden pinwheels transmit vibrations into the ground that may frighten moles away from an area. Commercial battery- and solar-powered vibration devices are available and claim effectiveness over areas of as much as three thousand square feet. As with all such products and claims, the buyer is encouraged to be skeptical and to seek a money-back guarantee in case the product proves ineffective.

Old-time mole catchers in England (where mole catching was once a substantial industry) sometimes used "squibs" (firecrack-

ers) to encourage moles to abandon tunnels. We included this as a historic note only and do not suggest this inhumane, and often illegal, practice be followed. If your interests go toward this sort of thing, the same source even claimed success in simply running over the tunnel system with a noisy lawnmower, a more easily condoned, if still likely ineffective, practice.

A Last Word

As goes the nation's love affair with lawns, so goes the homeowner's attitude toward moles. It certainly seem unlikely that Americans will abandon our cultural preference for these monocultural landscapes anytime soon. If anything, more acreage will be dedicated to this peculiar habitat and more resources devoted to its maintenance. No other ornamental landscape element on this planet receives such attention, and, perhaps, no other deserves it less. Some people undoubtedly feel it necessary to continue to battle moles over the appearance of their lawns—a battle in which we can only wish the moles well.

Resources

A very thorough and interesting work on moles is Martyn Goreman and R. David Stone's *The Natural History of Moles* (Comstock Publishing Associates, 1990).

25

MUSKRATS

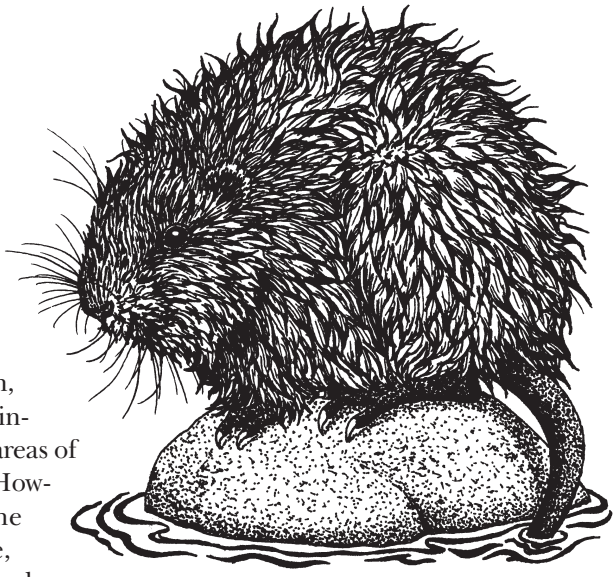


Figure 57 *Muskrat*

MUSKRATS are inoffensive, water-loving animals, who are often mistaken for their larger cousin, the beaver, or the human-introduced nutria in certain areas of their range (Figure 57). However, muskrats are not the engineers that beaver are, building more modest lodges and declining to build dams at all. Muskrats are important contributors to the healthy functioning of many aquatic ecosystems, particularly freshwater marshes. Most of these marshes were drained and back-filled long ago, first, because it was believed such lands bred pestilence, and later, because the land was coveted for development. Now that people are beginning to recognize the many important functions marshes perform, such as filtering polluted water, holding runoff to prevent flooding, and helping to preserve plant and animal species diversity, we regret the loss of so many of them. Muskrats are an important species in these threatened ecosystems and can help in the enormous task of restoring them—if people allow them to.

- **The identifying marks of muskrat tracks are hind footprints placed in the previous tracks of the front feet and the mark of a thin tail that has dragged behind.**
- **While more closely related to voles than to beaver, muskrats peacefully coexist with beaver and help to keep wetlands open by eating aquatic vegetation.**
- **Although for the most part retiring vegetarians, at times muskrats may eat animal foods and seem especially to enjoy shellfish (clams, crayfish, and mussels).**

Classification and Range

The muskrat (*Ondatra zibethecus*) is a rodent and the largest member of the group of rodents called the "microtines," which also includes tiny meadow voles. Muskrats are distributed widely throughout North America and even far into the northern reaches of Canada and Alaska. They are absent, however, from Florida, where a relative known as the round-tailed muskrat (*Neofiber alleni*) can be found. The rabbit-size muskrat is well adapted to an aquatic life, with partially webbed hind feet that function as paddles, a waterproof undercoat, and a long naked tail that is flattened laterally (rather than horizontally, as are beaver's tails). The average adult weighs two to three pounds and is between sixteen and twenty-six inches long overall. The normal coat color is dark brown, but individuals can range from black to almost white with underbelly fur generally lighter than that on the back.

Habits

Muskrats can be found in almost any body of water throughout their range, including drainage ditches, streams, ponds, lakes, and both freshwater and brackish marshes. Muskrats are active all year, with movement patterns varying according to climate. In more seasonal, northern climes, muskrats disperse in the spring and fall, with local movements in winter and summer often not extending farther than a hundred feet from their main dwellings. In warmer southern areas, long-distance movements can occur at almost any time of year. Dispersers without established territories are called "runners" and often move considerable distances. Like beaver, muskrats can slow their heart rate and use stored oxygen efficiently enough to remain under water for more than fifteen minutes. Muskrats are creatures of habit and repeatedly follow the same paths from their lodges, leaving visible channels in mud and marsh vegetation.

Muskrats use two primary types of dwellings: a burrow cut into a bank or a "house" or lodge of piled vegetation and mud that rises out of the water. Bank dens are more common along streams or ponds with limited vegetation. While the lodge resembles the living quarters built by beaver, it is usually made from soft, herbaceous vegetation, such as cattails, rather than from the tree limbs and other woody vegetation used by beaver. Muskrat lodges can be from three to almost nine feet across and are usually built in two to four feet of water or on the open marsh. The lodge can have several underwater entrances that lead to one or more internal nest chambers. Muskrats also build temporary feeding huts and even more temporary feeding platforms, where they can eat collected plants without having to go all the way back to the lodge. In frozen or snow-covered marshes, muskrats often build what are called "pushups" by cutting a hole through the ice and pushing vegetation through it to construct what looks like a dwelling on top of the ice. These are places to rest or eat during severe weather.

Muskrats are primarily plant eaters and prefer soft aquatic plants such as cattails, sedges, bulrushes, arrowhead, reeds, and algae. Plant roots and tubers are staples of their winter diets. They may eat small aquatic animals occasionally, such as clams and crayfish. By closing a special flap of skin in their mouth, muskrats can cut and carry food under water. Unlike beaver, muskrats do not cache a winter food supply; instead, they depend on finding roots or vegetation under the ice all winter long.

Muskrat breeding varies from one area of the country to another, with a tendency to larger litters and restricted breeding periods in the north and smaller litters and unrestricted breeding in the south. Breeding in the northern half of their range usually occurs from April to August, while in the deep south, breeding can occur year-round.

Gestation is about twenty-five to thirty days, and litters normally vary in number from three to eight. Young muskrats are altri-

cial (nearly helpless and furless) but grow rapidly and may be able to swim by the end of the second week after birth. The mother will dive with young attached to her nipples or belly skin but hold the young above water while swimming. The young usually reach independence at about four weeks, when the mother is ready to give birth again. Unlike many other mammals, these young are not chased off, although some voluntarily leave the natal (birth) den; the mother may simply excavate a new chamber in the lodge to bear her next litter. Sexual maturity is usually not reached until muskrats are a year old, and three to four years is probably the average life expectancy.

Water level variability appears to have the strongest influence on muskrat population density in a given habitat; the more constant the water level, the higher the density of muskrats the area can support. In prime habitat anywhere from five to twenty-five muskrats can live in an acre of marsh.

Public Health Concerns

Muskrats may become infected with tularemia, which may be transmitted to people through blood-to-blood contact or by eating inadequately cooked muskrat meat.

Problems

Local populations of muskrats occasionally increase to such densities that the habitat becomes overcrowded and animals denude aquatic vegetation. Such events, called "eat-outs," have apparently been found only in the southern part of the muskrat range. Muskrat burrows are often cited as threats to the structural integrity of ponds or earthen dams. On inland waterways, muskrats occasionally chew into Styrofoam™ ballasts of boat houses, docks, and piers. They occasionally feed on agricultural crops growing near water, but their limited home ranges and semiaquatic habit usually restrict the amount of damage they can do. Finally, muskrats occasionally show up in residential areas and may even take a dip in backyard pools.

Solutions

Tolerance

Muskrats rarely cause problems for people and add greatly to the biological activity of marsh communities. Their foraging habits may open up thicker areas of aquatic vegetation, providing access to other wildlife and increasing wetlands plant diversity.

Managing Impoundments

Because muskrats prefer steep slopes with dense cover for burrows, a gently rising incline (about three feet of slope for each foot of water depth) with little dense woody cover along the banks may deter burrowing. Where breaches occur, it is often because fluctuating water levels flood the initial burrow, encouraging the muskrat to burrow farther into the dam core. A burrow system may eventually completely pierce a dam in this manner. Restricting fluctuations in water levels to no more than six to eight inches will help to control burrowing. When the height of the dam above the normal water level is at least three feet, the structure will generally be resistant to problems from muskrat burrowing.

Dams imperiled by burrowing can also be protected by a continuous layer of riprap (four- to six-inch coarse stones or gravel) from two feet below the normal water level to two feet above it. A barrier can also be fashioned from welded wire, galvanized hardware cloth, or plastic netting buried along the same area, with plastic being the least costly and most durable of these materials. The barrier should be placed flat against the bank and anchored every few feet along the perimeter. Reef Barrier is a new, flexible, chew-resistant barrier for burrowing rodents, originally developed for prairie dogs. It has great potential as a muskrat deterrent on new construction or for resurfacing existing burrow-prone areas.

In extreme cases a trench can be dug in the middle of the pond berm or dam to three feet below the water level and filled with concrete. The resulting concrete core will block muskrats from digging through the dam. While this method of control is labor-intensive and costly, the trouble and expense may be justified if flooding poses a substantial risk to particularly valuable resources, such as buildings or crops.

Structural damage to floating docks or swimming rafts can be totally eliminated by encasing any exposed Styrofoam or other flotation material in galvanized hardware cloth or sheet metal.

In certain areas, such as golf course water hazards or private ponds, where muskrats' presence (but not their tunnels) can be accepted, some people have experimented with providing artificial dens for muskrats. If the muskrats accept the offered home, human neighbors can enjoy their ecological benefits without risking flooding.

Raptors (hawks during the day and owls at night) can substantially control muskrat populations. In the absence of natural roosting areas, these raptors can be encouraged by adding artificial raptor perches. Increased tolerance of and habitat protection for mink, raccoons, coyotes, and foxes may also enable natural predators to help with muskrat population control.

A Last Word

People often ask which animals are "good," as if it were the most natural thing in the world to judge them by what benefits they provide to humans. Even animal advocates can lapse into this faulty way of thinking. Bats are important, many say, because they perform mosquito control; snakes are valued because they eat rodents. Those are indirect services that can help humans, no doubt, but they do not so much justify why people should tolerate and accept these species as they add to our understanding of them. Tolerance comes through understanding and a raised awareness and acceptance of the diversity of life, not from a benefit calculation that reduces animals to the services they provide. But let's not kid ourselves; we're not there yet. So, here's the benefit muskrats provide: they will help people regain the wetlands we have wantonly destroyed and bring us back from the brink of the near ecological disaster we face as a result. Put them together with a few million beaver here and there, and the wetlands services will be significant—and human beings will never see a bill for any of it.

Resources

Paul Erington's classic *Muskrats and Marsh Management* (First Bison Book Printing, 1978) is the most cited and quoted work on these animals, who do not have that much of a following, frankly.

26

Opossums



Figure 58 *Opossum*

THE OPOSSUM IS the only marsupial found north of Mexico (Figure 58). Marsupials are distinguished by their unique mode of reproduction: their young are born in an almost embryonic form and make their way into a pouch, or marsupium, where they attach to a teat and are nourished for what in other mammals would be most of gestation. As is true for a few other species, opossums seem to have benefited from landscape changes occurring after European colonization by extending their range and, perhaps, increasing their numbers. But the northward expansion of these animals in North America was certainly already underway by the time Europeans arrived, as recorded in their earliest writings about the new continent.

Opossums figure prominently in the folklore and regional culture of many parts of the country. During the presidential campaign of 1912, Americans even flirted with the possibility of a "possum" party, led by the redoubtable "Billy Possum" (William Howard) Taft. However qualified for the job he may have been, Billy did not prevail, and American politics has been up to its ears in donkeys and elephants, but not possums, since.

- **Virginia opossums appear to be immune to pit viper venom. Studies have shown that bites from rattlesnakes, cottonmouths, and other pit vipers produce no tissue damage or immune response in this species.**
- **Opossums have indeterminate growth, meaning that they continue to grow throughout their lifetime. Females are smaller than males because large amounts of their energy are put toward reproduction rather than growth.**
- **The opossum has more teeth—fifty of them—than any other North American mammal and just as many as the now (fortunately for us) extinct Tyrannosaurus.**

Classification and Range

The opossum (properly, the Virginia opossum—*Didelphis virginiana*) is a medium-size mammal about the size of a house cat, with long guard hairs that give its fur a very coarse appearance. The opossum also has almost hairless ears and tail. Coat color varies from light, almost white, to almost black, but most coats appear gray. Opossums have prehensile tails capable of grasping and holding objects. While the tail might support the opossum's full weight briefly, the animal usually holds on with at least one foot as well when dangling from a limb. Perhaps because of the naked tail, opossums are often mistaken for rats. A large adult male opossum (males on average are larger than females) may weight twelve or thirteen pounds.

The opossum is found throughout the Midwest and eastern United States, is absent from the Rocky Mountain region, and is found again near the West Coast, where people imported them into California, Oregon, and Washington. Opossums are found in parts of eastern and western Canada, but the length and severity of the winters there appear to limit their presence. Temperatures that average less than 20 degrees F for any extended period severely tax these animals, who do not hibernate. They either must live off stored fat or count on frequent periods of mild weather when they can search for food. Veterans of hard winters can usually be recognized by the absence of parts of ears and tails lost to frostbite.

Habits

Opossums are found across a variety of habitats but seem to prefer deciduous woodlands. The opossum lifestyle has been aptly characterized as "terrestrial gleaner." Opossums move along the ground ceaselessly in search of food, without following prescribed trails or travel routes to known food reserves. In fact, adult male opossums may wander continuously, while females spend their lives in more defined areas but still move around almost randomly. While they may be more sedentary during the winter and when reliable food sources are available, most opossums seen in yards and neighborhoods are likely to move on without human encouragement or intervention. Their lives are spent wandering, although if a rich and reliable source of food has been found, they may tarry for a while. Opossums are most active at night.

Opossums are omnivorous and eat an amazing variety of plant and animal foods. They are not above scavenging carrion and raiding garbage that has matured to the point where other animals might turn it down. Invertebrates, including many types of insects, slugs, snails, and earthworms, can be a large part of their diet. Raids by opossums on poultry houses and gardens do occur, but they are less common than popular folklore insists.

Opossum young are little more developed than embryos when born. Females have two uteri, and internal development actually occurs in a shell membrane from which the embryo "hatches" before birth (marsupials lack a placenta). These tiny newborns will crawl instinctively upward and into their mother's pouch, where they attach themselves to one of as many as thirteen nipples there. Litter size may exceed the number of teats; in such cases, only the young who successfully attach to a teat survive. There they remain fixed for about sixty days before beginning to wean. Females may breed twice a year and, with successful litters of as many as a dozen young, this helps balance the high mortality in most opossum populations. A mother opossum with young clinging to her back and side is a popular image of these animals; young become independent at about three months of age. It is said that opossum young do not play. If true, this is a remarkable exception to a behavior that is quite widespread among mammals.

Opossums grow throughout their life, but these lives are usually short. The average female only lives through one breeding season, during which she raises two litters. Studies have shown that only about 25 percent of females survive to reproduce a second time, al-

though this percentage may be significantly higher or lower, depending on the location and habitat. A four-year-old wild opossum is exceptionally old. When confronted, opossums sometimes open their mouths to display their teeth and may even hiss. Although this appears to signal a formidable opponent, these animals are actually shy and inoffensive.

Rather than flight, when hard-pressed they will sometimes slip into the death-feigning catatonia termed "playing possum." The animal will fall on his side, mouth agape, drooling copiously. He may also discharge a foul-smelling greenish goop from his anal glands. This state of apparent death can last from a couple of minutes to upward of two hours before the "dead" opossum revives, looks around, and moves off once the coast is clear. Studies have shown no differences in physiological parameters of opossums when feigning death compared with those in an alert state. (A cautionary note in dealing with playing-dead opossums; never touch an animal without gloves or other, better protection against bites.)

Opossums are capable climbers and may take shelter by day in tree dens, old squirrel or crow nests, or aboveground nests they build themselves. Nest material is accumulated between the legs, and the prehensile tail holds it for transport. Ground dens are probably preferred over those in trees, at least in winter, and old woodchuck burrows might be ideal from the opossum's point of view. Nest material is also moved into these, and the openings are plugged, sometimes quite tightly, with leaves and other material. The preference for dens on the ground can lead them to take up residence under decks and in crawl spaces, where they may be considered unwanted guests.

Public Health Concerns

Opossums are susceptible to a variety of diseases of significance to humans, but their role in the transmission of any is uncertain. Rabies rarely occurs in opossums, as their lower body temperature is believed to inhibit its presence.

Problems

Opossums rarely initiate raids on garbage cans or gardens, but they might stop by to clean up the mess left by others, and thus catch the blame. In some places they acquire unsavory reputations by killing an occasional bird in a poultry yard, but real and even imagined opossum depredation is slight. Opossums are undoubtedly more beneficial as scavengers and consumers of undesirable invertebrates than harmful for any damage they cause. Far more complaints about opossums are generated out of concern about their mere presence than for any problems they create.

Solutions

Tolerance

Here is the primary message to homeowners who see an opossum in their yard and wonder what, if anything, they should do: don't worry. The animal will likely be moving on in very short order and is not a threat or a concern.

Exclusion

Where an opossum is denning under a porch or patio, the eviction strategy is much the same as for skunks. Monitor, by loosely placing leaves, straw, or other easily moved material into openings or access points; evict if the den is active; and exclude once you are certain no animals remain in residence. If anything, the process of eviction should be easier than it is with skunks, because the opossum carries her young with her. The probability that helpless young will be left behind is of little concern with this species.

Exclusion using one-way doors is effective. Another strategy is simply to wait until the animal has begun her nightly foray (two hours after dark is generally a safe time) and loosely close the opening with netting, straw, or other fibrous material that an animal trapped inside can push away, but one outside will not bother to disturb to get back in. The most effective method of discouraging visits

by an opossum is to secure trash containers with tight-fitting lids and pick up pet food at night if pets are fed outdoors.

Opossums occasionally find their way into houses through pet doors. The general rules for encouraging any animal to leave the house apply; stay out of her way while providing an obvious route to exit. Unlike raccoons, opossums may be docile and just oblivious enough to need gentle encouragement with a broom to shoo them on their way. (Don't try that with a skunk.)

A Last Word

Many myths and misconceptions surround opossums. Perhaps the most widespread is that they are more primitive than other animals, so much so as to lead some to describe them as "living fossils." In an evolutionary sense, they do retain an ancestral mode of reproduction that is no longer true of most other mammals. Unfortunately, the implication of primitiveness usually goes beyond that, generalized to include their conservative behavior and so-called lower intelligence. People may perceive opossums as stupid because they do not do well solving problems designed by people to measure intelligence. However, the bottom line on opossums is that they have survived far longer than most other contemporary mammal species and clearly have passed Nature's test of time with high enough marks to be declared a resounding evolutionary success.

Resources

The Opossum Society of the United States' website includes a lot of good information about opossums and appropriately discourages keeping these animals as pets. It can be accessed at:

www.opossumsocietyus.org.

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Pigeons



Figure 59 *Pigeon*

Pigeons are quintessential city dwellers, molding people's feelings about urban birds, and, for many urbanities, perhaps, birds in general (Figure 59). Those feelings often are not kind, as the oft-given descriptive "feathered rats" suggests. Pigeons were originally Old World cliff-face dwellers who are now doing nothing more than living on the artificial cliffs the urban environment provides in abundance. Early settlers imported pigeons to serve as food animals and message carriers; some inevitably escaped to freedom, and pigeons have flourished in North America ever since. They can dart in and out of foot and vehicular traffic as skillfully as the most citified human. One story even tells of a pigeon who hopped on the subway and rode for a stop or two before disembarking. These gentle but tenacious birds have become so much a part of the urban scene that it is hard to imagine what our cities would be like without them—except, poorer.

- **Pigeons are able to sense Earth's geomagnetic field through a unique physiological ability, helping them to fly home from distances great and small.**
- **Pigeons can also perceive polarized light in the sky and hear infrasonic (very low frequency) sounds, an ability shared by elephants.**
- **The Egyptians sent homing pigeons in all directions with news of the coronation of Ramses III more than three thousand years before the United States was founded.**

Classification and Range

"Our" pigeon is Columba liva, a member of a large family of birds (Columbidae) that in-

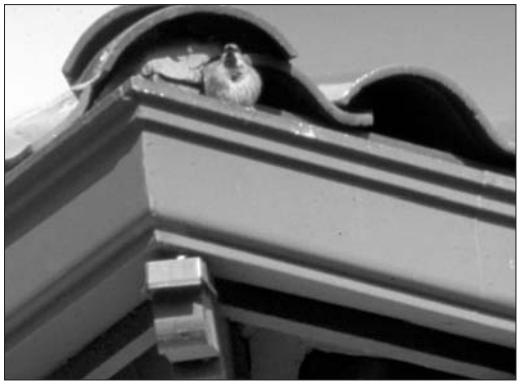


Figure 60 *The architect can be forgiven for creating this ideal pigeon habitat when designing the outside of this house. The pigeon can be forgiven for taking advantage of the opportunity. The humane solution here is to exclude all pigeons from access, something that can be accomplished successfully with the proper tools.*

cludes all other species of pigeons and doves. The current accepted common name for this bird is rock pigeon, although it is also called the common pigeon, feral pigeon, homing pigeon, and rock dove. Pigeons have long been raised in captivity, and an astonishing variety of forms attests to long human experimentation with genetic variants. Along with domesticated dogs, Charles Darwin used this species as an example of the extent to which animals can be changed by selective breeding (artificial selection) as an analogy for the process of evolution through natural selection. The classic urban pigeon is a plump-bodied bird with a small head, black bars on her inner wings, a white rump, and a dark band at the end of her tail.

Habits

Pigeons were first introduced to North America in the early 1600s. They currently live throughout the United States, Mexico, and most of southern Canada. In the west populations are found as far north as southern Alaska. Although primarily urban birds, large populations of pigeons can be found in small towns and around farms as long as dependable food sources and shelter are available. Pigeons are gregarious and tend to favor small flocks of around twenty to thirty birds, although far larger aggregations of hundreds of individuals made up of numbers of flocks can also occur.

Pigeons appear to be dietary generalists, because they do sample all of the many foods offered them by people in city parks, but their preferred foods are seeds and grains. Humans regard them as inveterate panhandlers, but where they have been studied, they have been observed eating waste grain and seeds from city flora as well as foods (bread, leftovers, or birdseed) people provided.

Pigeons breed throughout the year, even during winter, and can raise six to ten broods annually. Pigeons have exhibited clutch overlap, meaning that they may lay another pair of eggs while still rearing the last set of hatchlings. The more combined experience a mated pair has with raising young, the more overlap there will be between clutches. The female usually lays two eggs (less often, one or three and, rarely, four), sheltering them on a crude and loosely constructed nest structure without a lining. The nest of branch and root pieces and occasionally leaves is built on a ledge, such as a building windowsill or a bridge girder. The same nest may be used repeatedly to raise multiple broods over a period of many years. Hence these nests may become cemented aggregations of feces, unhatched eggs, mummified young, feathers, and nesting materials that grow bigger month by month.

Parents take turns incubating the eggs for sixteen to nineteen days. After hatching, the young are fed crop milk for about the first two weeks. (This is a special secretion that both parents produce from the lining of the crop, a saclike food storage chamber that projects outward from the bottom of the esophagus.) Crop milk is a highly nutritious and efficient way of feeding young birds, and, apparently, one that developed independently in such diverse bird species as budgerigars, flamingos, pigeons, and penguins. Young pigeons fledge at four to six weeks of age, but they remain dependent on their parents for another week or two beyond that.

Public Health Concerns

Pigeons play a role in the environmental concern about histoplasmosis and are known carriers of *Cryptococcus* and *Salmonella*. However, there is little evidence linking pigeons directly to human infections.

Problems

To some, pigeons are universally a visual and aesthetic problem. To others, they are a problem only when present in great numbers or when roosting on buildings or under bridges. Their droppings can mar building facades, and if left to accumulate over a long period, can cause permanent disfigurement (Figure 60).



THE HSUS

Figure 61 *This owl effigy provides pigeons with something to sit on when the branches of the tree are too small for that purpose. Beyond that it has questionable value.*

Solutions

Tolerance

To those for whom pigeons are an irritant or eyesore, remember that they are one of the few animals that will tolerate the inner-city environment people create. We think of deserts as barren places, but they teem with life compared to the industrial core of our cities. The pigeons there can be considered a vanguard of other species that might come when conditions improve.

Limiting Feeding

Most authorities agree that the real key to controlling pigeon numbers is limiting the availability of food. Concentrating food, as when industrial spillage is an issue or intentional feeding gets out of hand, not only draws numbers of pigeons in, it also provides the nutritional fuel for their reproductive fires. Frequently large numbers of these birds are supported by well-intentioned individuals who regularly feed them bread, table scraps, or birdseed. Generally, feeding is incremental. From a modest beginning, the feeder encourages more and more birds to appear or stay in the area, thus requiring more feeding and further enhancing bird numbers. Eventually the situation can get out of control, to the detriment of all concerned.

The golden rule of pigeon feeding is moderation. Feed only as much as birds will eat in five to ten minutes and do not feed with clockwork regularity, which conditions the birds to appear at the same place, same time, every day. When excess feeding has been established, a gradual reduction over several weeks to a reasonable baseline amount is recommended. Feeding schedules and amounts can be adjusted for weather or unusual circumstances, provided the feeder is aware of and responsive to the adverse effects of this activity as much as to its positive ones. Signs, brochures, and public service announcements about feeding can reduce or eliminate the supplemental feeding that often attracts large numbers of birds to specific sites.

Exclusion

Pigeons prefer to perch on flat surfaces and they require them to nest. Nests are usually built under shelter and in as much of a cubby as the parents can find. Wood or metal sheathing installed at a 45- to 60-degree

angle as a cover over frequently used ledges will keep pigeons from landing. It is best when such structural deterrents to roosting are incorporated into the design of buildings, but that might involve too much foresight for most planners.

Bird wires will exclude pigeons from ledges, railings, awnings, and rooftops. Any type—single-strand, coils, or porcupine wire—is effective, but where problems are severe or pigeons numerous and persistent, seek expert advice about the most practical approaches. Electric shock, once commonly added to enhance the effectiveness of wire barriers, has generally been replaced by specially designed tracks to administer shocks where the pigeon problem is so serious it merits this extreme.

Netting is the tool of choice for many conflicts with pigeons, as well as with other urban birds, when large areas have to be treated. Netting can exclude birds from virtually any type of structure, from a detached house to an office building. To evict birds from window ledges, the netting is anchored to the roof, draped across the front of the structure, and then tightly secured to the base and sides of the building. Netting can be used under bridges or inside buildings where pigeons perch on beams, girders, struts, and supports, and it can be suspended below the perches to create a false ceiling that excludes the birds. Large-scale applications of netting almost always require professional installation. A growing number of new products provide excellent long-term solutions to urban bird problems. Door curtains can prevent birds from flying or walking into buildings, especially warehouses and other buildings with large loading dock doors that must be left open frequently for access.

Scare Devices

Effigies, such as the oft-used plastic owl, can be used to frighten pigeons away temporarily (Figure 61). This is only a short-term solution, because most of the ones we've seen work for a while, only to decrease in effectiveness as the pigeons figure them out. (If food is present, they may never work.) Owl models that move in the breeze or are motorized stand a better chance of achieving some result. But pigeons, much like other birds, readily recognize what is dangerous and what is not and quickly come to ignore what is not.

Repellents

Sticky gel (polybutene) repellents registered for pigeons are not recommended, nor is the chemical product Avitrol®. A new repellent appearing on the market, based on the chemical anthraquinone, may hold great promise in keeping pigeons from roosting or loafing on structures where they are not wanted. When applied to roosting sites, this compound may be ingested through pecking or preening on the treated substrate. Ingestion causes intestinal irritation, and this unpleasant experience teaches birds to avoid treated areas.

Other Concepts

In 2007 the EPA approved a new contraceptive product, OvoControl-P, for use in pigeons. Fed as a food bait by licensed professional applicators, this product holds great promise as a way to reduce pigeon numbers humanely where pigeons are problematic.

Municipal Planning

Pigeon problems are often municipal problems and require coordinated planning focused on humane and lasting solutions. These solutions seek to (1) change human behavior, such as feeding and trash management, (2) exclude pigeons from buildings and other places where they are not wanted, and (3) modify habitats, such as roosting, nesting, and loafing surfaces, to reduce their attractiveness or availability to these birds.

Some cities have adopted an approach to stabilizing pigeon populations by using structures called dovecotes. In use since ancient times, dovecotes appeal to the birds and lead them to preferentially nest and lay eggs in these specifically designed structures. In the past these houses were used to provide nesting and roosting sites for pigeons and doves

who were allowed to eat farmers' crops only to be harvested as a delicacy. This was considered a form of pigeon farming. Today eggs simply are removed from dovecotes before they can be incubated. While such systems offer promise, their details and efficacy have yet to be worked out and demonstrated over the long term.

Pigeons are, and will remain, part of the living community of our cities and towns. They become an issue only at specific sites and under certain circumstances. Resolution of problems with people should be approached on a case-by-case basis, not with misguided attempts at blanket reductions in pigeon populations through poisoning and killing.

A Last Word

The cities we have so proudly built contain many artificial cliffs and ledges that attract pigeons, while human residents provide food offerings that sustain them. Ecologists looking at urban buildings sometimes describe them as cliff-detritus zones—places where skyscrapers function like cliffs to set wind circulation patterns, maintain microclimates about themselves, and capture windblown seeds and other organic detritus. No one has yet studied this habitat in any detail. When aspiring ecologists do, they no doubt will uncover surprisingly high levels of biological diversity, with many species of microorganisms, insects, plants, and animals adapting rapidly to this special niche. Somewhere near the top, and likely to represent the greatest total biomass of all, will be the pigeon.

Resources

A comprehensive and fascinating look at pigeons can be found in Richard Johnston and Marian Janiga's *Feral Pigeons* (Oxford University Press, 1995). Andrew D. Blechman's *Pigeons* (Grove Press, 2006) is a must read for anyone interested in learning more about these birds.

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Pocket Gophers



Figure 62 *Pocket gopher*

THE TITLE "gopher" is often used by the public for a wide range of ground squirrels, rodents, and insectivores such as voles and moles. The species described here are true gophers and are placed in their own family group, the *Geomyidae* (Figure 62). The term "pocket" refers to their unique, fur-lined exterior cheek pouches, which they use to carry cached food or vegetation for den bedding. Pocket gophers live primarily underground, coming to the surface to bring up compacted earth, maintain their tunnel holes, or avoid flooding. Built for digging, they have short strong legs, wide feet, and long claws. Their front teeth are also routinely used for this purpose, and a special flap of skin behind the front teeth prevents soil from getting into the pocket gopher's mouth.

Because pocket gophers and moles both live underground—a trait termed "fossorial"—many people confuse the two species. The two do occur together in parts of their range, and both do bring soil to the surface in mounds, but there the similarity ends. Mole

- **A pocket gopher's fur-lined cheek pouches can be turned inside out and used to transport food or nesting material.**
- **To empty their cheek pouches, pocket gophers squeeze the contents forward with both paws.**
- **By himself, one pocket gopher may bring two to four tons of soil to the surface in a year's time.**

activity tends to include feeder and transport "ridges" at the surface, while pocket gopher tunnels tend to be deeper and surrounded at the surface by expelled earth and roots. Mole earth mounds are round with a center hole in which the earth is pushed up. Pocket gopher mounds are more fan- or cone-shaped, with the earth evacuation hole at the narrow end of the mound.

If you are fortunate (and quiet) enough to observe pocket gopher earth-moving activity, you will likely only see soil erupting from the ground, and, perhaps, the soles of the animal's back feet as he uses them to push soil from the tunnel system. Pocket gophers are fastidious about maintaining their tunnel system and react quickly when any hole is made in the mound to let light or air into the tunnel network. Some clever and opportunistic predators, such as ravens and badgers, have learned to disturb the mounds on active tunnels and then wait quietly for the gopher to come near the surface, where the animal can be ambushed.

Classification and Range

Pocket gophers are found only in the New World, and North America is home to three genera (*Thomomys*, *Goemys*, and *Pappogeomys*) and eighteen species. There are five genera and thirty-five species in total in the western hemisphere. Pocket gophers are found throughout most of the Midwest and the West as well as in the southernmost parts of Alabama and Georgia, into Florida. They also range north into parts of Canada through Alberta. As is the case with many other rodent groups, pocket gophers' taxonomic relationships are highly complicated as a result of diversification and adaptation to specific microhabitats.

Habits

Pocket gophers in North America vary in size from five to thirteen inches and have small eyes, ears, and tails as well as short muscular forelimbs with prominent claws. Their yellow-orange incisors are always visible, even when the mouth is closed.

Although they are burrowing animals, pocket gophers occupy a surprising range of habitats, including some that are fairly rocky. Exactly what types of soils support them in their greatest abundance remains to be determined, but porous, well-drained types are clearly preferred. In fact, some think the biological diversification these animals have undergone have been caused by their adaptation to different types of soils.

Pocket gophers are herbivores: they live almost entirely on plants. Much of their feeding occurs in tunnels, where they consume the roots of plants. They will also feed on the surface in brief bouts of activity right outside a tunnel exit. The roots of dandelion are an important food for pocket gophers, and the entire plant may be consumed when it can be pulled into the tunnel. Annual grasses and forbs (plants that die back in winter) make up the bulk of the diet, but many agricultural crops are readily consumed—especially alfalfa.

In the northern part of their range, pocket gophers usually have one litter each year; in the south, they may give birth twice. Gestation is said to be about thirty days, but the wide range of reported dates suggests this needs further study. The average litter ranges from three to five young, but litters with as few as one or as many as thirteen have been found. The young remain in the nest for several weeks after birth but are expelled by the mother eventually and have to start their own burrows.

Tunnels are sometimes quite close to the surface, but they may be as deep as two feet. Burrow systems generally consist of a main tunnel that is six to eight inches below the surface, leading to a series of lateral branches. The nest chamber, as well as food caches, may be five to six feet below the surface. The industry and energy that goes into burrowing and the amount of earth that is cast off are considerable. Using her teeth and claws to tunnel (different species vary in how often they use one or the other technique), the pocket gopher loosens soil, then somersaults in the

tunnel to turn around, so that she can push the excavated material to the surface. The amount of material a local population of pocket gophers can bring to the surface has to be measured in tons, indicating a significant positive influence on the soil ecology of regional areas when these animals are present.

Public Health Concerns

Pocket gophers are not implicated in the transmission of any disease to humans.

Problems

Like many other small rodents, pocket gophers sometimes undergo dramatic population increases or "irruptions." The appropriate conditions are often provided by humans preparing agricultural land. By removing a natural community of plants to prepare land for a single crop, farmers create superabundant food resources that are bonanzas to animals like pocket gophers. The population increases that logically follow can generate substantial economic loss—as much as 25 percent of a crop. Loss such as this is certain to evoke significant responses, leading to major efforts to destroy the "pest" in accordance with the damage he does. If this elimination works at all, it does so only briefly, to be followed by the rebound of the species when nothing has been done to address the root cause of the problem. Even those who advocate vociferously for lethal control are recognizing the inevitable circular path this course follows.

Solutions

Tolerance

It is possible that landowners may tolerate pocket gopher activity more than that of other burrowing species, such as prairie dogs and ground squirrels, because there is no open tunnel entrance and because the human beings seldom, if ever, see the animal who is engineering the soil modifications. Many others would not consider tolerating pocket gophers because of the assumed belief that leaving them alone would lead to even more damage. This is a common mind-set when wild animals and their conflicts with people are considered but also an assumption that frequently does not hold up when examined closely. Regardless, a better understanding of any animal and its ecology is always germane to dealing with the problems such animals cause. For the homeowner and small-time gardener, pocket gopher activity may be an occasional nuisance or aesthetic inconvenience in lawns, ornamental plantings, or garden beds, but not a long-term problem or threat. Where the animals are not so numerous as to be causing heavy damage, the homeowner should consider them as neutral or beneficial.

Exclusion

Fencing and some exclusion techniques can be expected to have only a limited applicability in controlling pocket gopher damage. In neighborhoods where trenching can be done safely along fence lines, installations of eighteen- to twenty-four-inch barriers of galvanized-after-welding hardware cloth or the new environmentally friendly fabric barriers can be effective at excluding pocket gophers and other subterranean rodents from a yard. The barrier should also extend four to six inches above the surface and be attached to the wooden or chain link fence. The reduced cost and long life of the fabric barriers present some new tools and strategies for promoting coexistence with suburban rodents but they still need to be evaluated critically to determine their benefits and cost-effectiveness.

Habitat Management

Where pocket gophers are problems in agricultural settings, success in limiting damage has come through a variety of habitat management practices, ranging from planting alternate crops to crop rotation and flood irrigation. All of these lower the suitability of the habitat for pocket gopher occupancy. Such approaches are less practical in residential areas, however. As with any rodent problem,

the tolerance and encouragement of natural predators can lead ultimately to some of the best solutions. Artificial perches for raptors and tolerance of fox, coyote, or snake presence can go a long way toward creating a predator-prey balance. In newer suburban neighborhoods, pocket gopher presence may be only temporary, as the populations succumb to the habitat changes caused by development taking over the area.

Repellents

There are no repellents currently registered for use on pocket gophers, and home remedies that might work on other species are less likely to be usable for them, because of the difficulty of reaching animals underground. There is little evidence that the rodent- or mole-control techniques, such as vibrations, sound, electronics, or radio frequencies, have any effect on pocket gopher activities. Where underground cables may be vulnerable, they can be enclosed in PVC (about three inches in diameter) or laid in trenches that are surrounded by six to eight inches of coarse gravel.

A Last Word

The positive and beneficial environmental roles of pocket gophers have been little acknowledged in the past and, even when they have, not taken to heart. The enormous amount of soil they move alone suggests they serve an important function in directly influencing soil ecology and plant community structure. It would be naive to imagine that lethal control will not remain the practice of choice for resolving pocket gopher problems into the foreseeable future. A little understanding and appreciation of the role these animals play in the larger ecological context will go a long way toward building a better set of responses to them.

Resources

There is *lots* of information out there on how to kill pocket gophers—and not much else. But a good summary of natural history can be found in the chapter on these animals by Robert Baker, Robert D. Bradley, and Lee R. McAiley, Jr., in *Wild Mammals of North America* (second edition) (Johns Hopkins University Press, 2003).

29

PORCUPINES

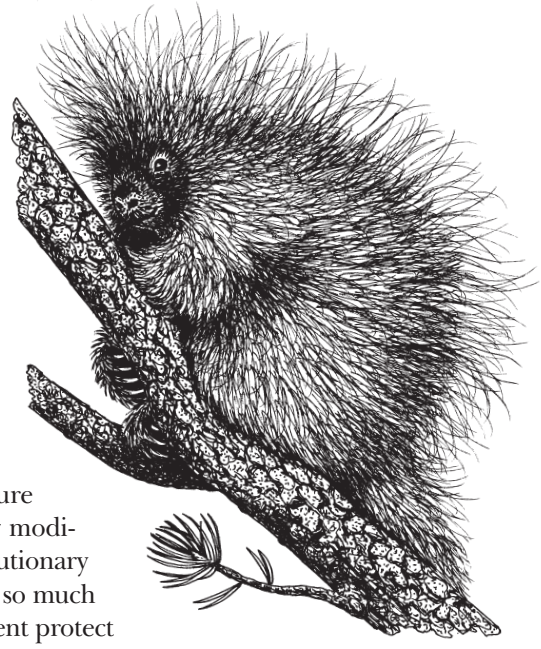


Figure 63 *Porcupine*

CONTRARY TO popular belief, porcupines cannot impale people, or their pets, by shooting their quills through the air (Figure 63). Although these specially modified hairs are marvels of evolutionary adaptation, they can only do so much to help this slow-moving rodent protect himself. An attacker must actually come into contact, however slight, before a porcupine's quills dislodge and embed themselves. Unless porcupines are provoked, no harm is likely to come from these otherwise benign and interesting creatures. If you leave the porcupine alone, then he will go his way and certainly not interfere with you going yours.

Classification and Range

The North American porcupine is in the family Erethizontidae, which contains four genera and twelve species of New World porcupines. It is the only member of its genus *Erethizon*. *Erethizon dorsatum* is a large-bodied, slow-moving rodent who would be ill-equipped to avoid any sort of predator were it not for his formidable natural defensive sys-

- **Porcupines are known to be slow and cautious climbers, but injuries in skeletal remains found below trees indicate that a fair number of them do fall from their perches; whether this happens while awake or asleep is not known.**
- **Strictly vegetarian, porcupines prefer to retreat, rather than confront; if left alone they will not attack. If threatened they may retaliate with a bristling tail slap.**
- **The quills, modified hairs that are loosely attached to voluntary muscles beneath the skin, are present from birth and are functional once dry—all thirty thousand of them.**

tem. Porcupines range throughout most of Canada and the western United States, as far south as northern Mexico, and throughout northern New England and much of New York and Pennsylvania.

A full-grown porcupine is generally about two to two and one-half feet long and weighs eleven to thirty pounds, with males being larger than females. The porcupine is the second-largest rodent in North America, after the beaver. The quills are their hallmark: a sheath of muscle controls quill movement so that quills can be raised in warning when the porcupine is threatened. Stressed porcupines may also produce a noxious odor and chatter or clack their teeth to tip off would-be assailants.

As many a dog owner living in porcupine country has discovered, ignoring this warning can lead to big problems. Porcupines often back up toward their attackers, the better to lash out with their heavily quilled tails. The end of the quill is made up of microscopic, backward projecting barbs that, once embedded, cannot be pulled out easily. These barbs facilitate the embedding of quills deeper into the body. Serious injuries, even fatalities, can occur to both wild and domestic animals who come into contact with a porcupine. In fact, even one human fatality has been documented, this an individual who ingested a quill in a porcupine meat sandwich.

Habits

These nocturnal creatures are widespread and well adapted to life in a variety of habitats. They thrive in such varied locations as deciduous forests, high desert, and sagebrush, but most commonly live in coniferous forests.

Porcupines are strict herbivores (plant eaters), although when the plants they eat are lacking in sodium content, they may resort occasionally to consuming carrion to obtain this vital mineral. During the winter they eat the woody parts of plants, especially the inner bark (or cambium) of trees. Porcupines eat virtually all species of trees within their range, but preferences vary regionally or even individually. They may favor hemlock, Douglas fir, and ponderosa pine among evergreens, and maples, aspen, ash, oaks, beech, and birch among deciduous or hardwood trees. In spring and summer, porcupines eat herbaceous plants and nip off the ends of tree branches to get to the leaves, buds, nuts, and fruit. These nipped branches may litter the ground beneath the trees that porcupines are using. Like other many other rodents, porcupines are hind gut fermenters who possess an enlarged cecum (homologous to the human appendix) where much of their digestion takes place. Nitrogen is a crucial resource for this species, and this requirement must be balanced against the chemical defenses and toxins of potential food items. To retain as much nitrogen as possible from their nutrient-poor, fiber-rich diet, porcupines retain food in their digestive tracts for extended periods, resulting in very low fecal nitrogen loss.

Breeding occurs in the autumn and is followed by about a 210-day gestation period. This is unusually long for a rodent—almost five times longer than the gestation period for squirrels and about equal in length to that of the white-tailed deer. Many humorous speculations have been made about porcupine mating; although the oddest aspect of their courtship does not involve their quills. Male porcupines actually spray females with high velocity streams of urine with greater and greater frequency until the onset of the female's estrus period. Although the physiological reason for this behavior is yet unknown, it may promote the onset of estrus.

Rival males are sometimes rather aggressive and combative with one another, often resorting to the most formidable weapon in their arsenal, the quills. Females bear a single young in the spring. While fully capable of foraging on his own within a few weeks, the young porcupine will continue nursing from his mother for as long as four months.

Public Health Concerns

Porcupines do not carry any communicable diseases of concern to humans. The main safety issue with these animals is the possibility of being quilled. The barbed tips on quills work them ever-deeper into the flesh, a painful process that is aided by the greasy coating on each quill. Pets who have a run-in with a porcupine should be treated immediately by a veterinarian, both to ensure that quills are removed correctly, with as little discomfort to the pet as possible, and for evaluation and treatment with antibiotics if deemed necessary. Humans who have embedded quills should consult a physician to determine a course of treatment.

Problems

Porcupines occasionally damage structures and implements left outdoors, such as shovel handles and boat oars. Because their food has little sodium content, porcupines may hunt far and wide to satisfy their salt needs, particularly in the spring. People who spend time outdoors in porcupine country know that these animals are attracted to tools and implements that have salt on them from sweat. Even aluminum oars are occasionally found gnawed. Porcupines can also be attracted to the layer of glue that bonds plywood, attacking plywood on structures. Car tires and hoses may also attract attention, because of their mineral content. Unfortunately porcupines may be lured to their demise by the salt spread on roads to control ice in the winter.

It is fairly obvious and distinctive when a porcupine strips the bark on a tree, only occasionally to be confused with similar damage caused by squirrels. Tree damage, including bark stripping, can be a rare but important issue in commercial forest stands. Damage to individual trees in settled areas doesn't happen very often and is addressed more easily.

Solutions

Tolerance

The appealing and almost entirely benevolent disposition of porcupines makes them enjoyable animals to be around. Most people will never get to see this animal in the wild, much less have the repeated contact with them that could lead to conflicts. Still, we understand that a chewed-up tool handle could cause some pique, until the owner of the tool realizes that it would probably be best just to make sure it is not accessible to the porcupine. The mistaken impression of the porcupine is of a dangerous creature who will ultimately cause harm to people and their pets. The truth is that, unless they are provoked, no harm is likely to ever come from them.

Exclusion

Where individual trees need to be protected (as, for example, small orchards), a metal band twenty-four to thirty inches wide can be placed around the trunk about three feet off the ground. This prevents porcupines from climbing the tree and, because porcupines are not nimble climbers and rarely cross from one tree to another aboveground, it is likely to be quite effective. It is best not to leave these bands on trees permanently—insects may accumulate, lay eggs, or overwinter underneath them, and the trunks of sensitive trees could scald if the bands are removed after being on for a long time. Take into account winter snow cover and place bands three feet above the expected maximum level of the snow pack.

Repellents

A capsaicin-based hot sauce repellent is registered for porcupine damage to plastic tubing, particularly targeted at lines and fittings on maple syrup collection equipment. Its effectiveness for sugaring holds out some hope that it will be equally effective on car hoses or other things porcupines might find tasty. Preservatives, such as copper naphthenate and pentachlorophenol, used in the manufacturing of plywood, also appear to have some

repelling properties, even though they are not registered as animal repellents.

A Last Word

Keep your porcupine friends close, but not touching. It's okay to touch the dog, though. And even better to hold him if you ever encounter a porcupine going on his way.

Resources

Uldis Roze's *The North American Porcupine* (Smithsonian Institution Press, 1989) is a comprehensive and fascinating tale of the natural history of these amazing animals. It explains, for those who have always wondered about the porcupine's attraction to salt, exactly what that is all about. How do potassium and sodium salts affect porcupines? And how can you tell? Read the book, because we're not telling you here—besides, you wouldn't want to miss reading more about these fascinating and seldom seen animals.



30

Prairie Dogs and Ground Squirrels

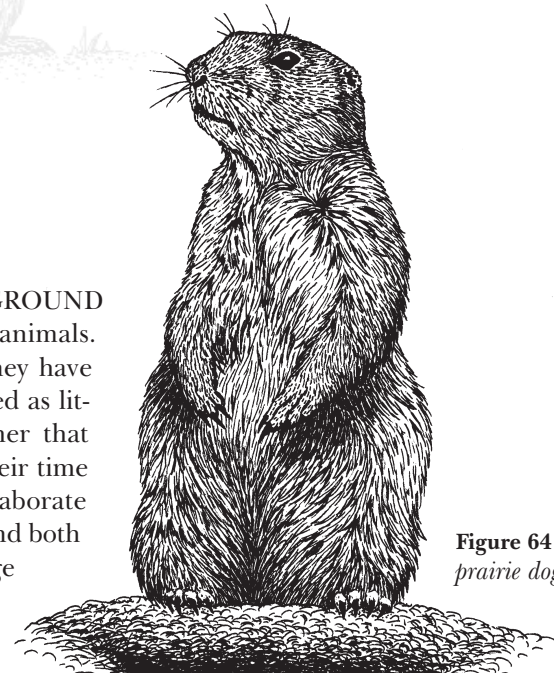


Figure 64 *Black-tailed prairie dog*

PRAIRIE DOGS AND GROUND squirrels are fossorial animals. This does not mean they have gone extinct and are preserved as little lumps of stone, but rather that they spend a good deal of their time underground. Both build elaborate tunnel and burrow systems, and both have adapted to a wide range of different habitats. Prairie dogs (Figure 64) and ground squirrels often live in large groups, and some species have highly complex social relationships, while others are markedly less social. All tend to look somewhat alike, but when you take a closer look, you find many differences in appearance and behavior (Figures 65, 66).

Near the end of World War I, California became the first state to declare an official "ground squirrel week." The event was not to honor these plucky little rodents, however, but to better organize their destruction. Schools and shops were encouraged to close, so that both children and adults could drive squirrels from burrows and club them to death. While this particular state holiday has disappeared, some localities in the United States and Canada still hold annual or semi-annual contests to kill as many ground squir-

- **When prairie dogs hear an approaching thunderstorm, they try to prevent flooding of their burrow by quickly surrounding the entrance with a dike.**
- **Prairie dog grazing increases plant species diversity and richness and landscape heterogeneity, attracting bison, pronghorn, and elk. As a keystone species, prairie dogs directly help as many as 163 species of plants and animals.**
- **Early settlers encountered a prairie dog town in the Texas panhandle 250 miles long and 100 miles wide, home to upward of 400 million animals.**

rels as possible. Prairie dogs are sometimes favored as live targets in organized shoots on remote public lands, miles from anyone's lawns, crops, or other areas where conflicts with people could occur.

Classification and Range

Prairie dogs (*Cynomys spp.*), ground squirrels *(Spermophilus spp.*), and antelope squirrels (*Ammospermophilus spp.*) include numerous species that live in diverse habitats throughout North America. In the United States, they occupy most areas west of the Mississippi River. All are members of the squirrel family (*Sciuridae*) that includes the closely related marmots (including woodchucks) as well as tree squirrels and chipmunks.



Figure 65 *Golden-mantled ground squirrel*

There are five species of prairie dogs and more than thirty species of ground squirrels in North America. Among prairie dogs, the black-tailed (*C. ludovicianus*) is most likely to be in conflict with people. Even though this species occupies only 2 percent of its former range, it is still more widespread than are other prairie dog species. Black-tails are also more social and live in denser colonies than other prairie dogs. Among the ground squirrels, the thirteen-lined (*S. tridecemlineatus*) is most widely distributed and the one that most often comes into conflict with humans.

Ground squirrels and prairie dogs are medium-size rodents, averaging about a foot or more in length and weighing about two to three pounds. Coat color varies widely, but it is generally brownish, with lighter and darker variants in both groups. Some ground squirrel coats feature faint spots or bold white stripes. Prairie dogs have distinctive black, white, or gray-white tail tips, and two species, the white-tailed and Utah prairie dogs, have a dark line above each eye.

Habits

Prairie dogs occupy a variety of grassland habitats; the relatively widespread black-tailed prairie dog specializes on short- and mixed-grass prairies. Ground squirrels are also found in prairie and grassland areas, but many species are found in scrub and brush land, desert, and even woods. One of the reasons there are so many species in this group of animals is that they have adapted to a wide variety of habitats. Both prairie dogs and ground squirrels are herbivores (plant eaters). Grasses and forbs are the mainstay of their diets, but these may be supplemented with insects or an occasional small mammal or bird egg.

Many ground squirrels and prairie dogs hibernate, although the black-tailed prairie dog does not, relying instead on his fat reserves to get through the winter. Some also may go dormant (estivate) for short periods during the hottest summer months, whether or not they also hibernate during winter.

Ground squirrels and prairie dogs are not the prolific breeders they are often made out to be. Females can produce no more than one litter of three to nine pups per year. Many species do not reach sexual maturity until they are two years of age, very late for animals who rarely survive more than six years in the wild. In most prairie dog species, each female is in estrus for only one day of the breeding season each year. Mating generally occurs in early spring, followed by twenty-one to thirty-eight days of gestation and twenty-four to fifty-one days of nursing before weaning, depending on the species. Between 50 and 97 percent of the young born each year will die before the next, due to overwin-

ter mortality, predation, or infanticide (the killing of young by adults of their own species).

Prairie dog towns, as their colonies are called, are identified by their many small mounds of excavated earth next to burrow entrances, where prairie dogs sit to scan for danger, and which also may serve to help keep water from pouring into burrows during heavy storms. Belowground burrows may be anywhere from two to six feet deep and fifteen feet long. Ground squirrel burrows are similar to those of prairie dogs, though entrances are usually not on top of such obvious mounds. Both can have several entrance-exit holes to escape predators, such as rattlesnakes, who can follow them in the front door, or badgers, who can dig them out.

More than the other species in this group, the black-tailed prairie dog lives in large social groups, based on a unit called the coterie that is organized around one or two related males, their harems, and offspring. Large prairie dog towns were frequent phenomena of the Old West and still can be found in places today. Other prairie dogs and many of the ground squirrels are also quite social, living in groups based around close female relatives from which most males and some females disperse before sexual maturity.

Public Health Concerns

Prairie dogs and ground squirrels can host the fleas implicated in the transmission of bubonic plague, and some people advocate population control as a result. We can see some merit in this, if the population in question is the flea, not the prairie dog or squirrel. Recent research has shown that "dusting" colonies with insecticides such as deltamethrim (delta dust) or pyraperm not only kills fleas but may also halt the spread of plague in colonies that have already been infected.

Problems

Prairie dogs and ground squirrels are often accused of damaging agricultural crops, pastures, lawns, and gardens, by either directly eating plants or trimming them, as is their habit, to ensure a good field of vision. Some people fear that prairie dogs' burrows may create hazards for livestock, people, and farm machinery. The severity of conflicts with these animals is often exaggerated, due to widespread notions that these animals are nothing more than "pests."

Solutions

Tolerance

Sometimes the damage animals actually do is much less than believed, and sometimes what some see as "damage" is actually a benefit that goes unappreciated. This is the case with prairie dogs and ground squirrels. Recent studies on the overall ecological services these animals provide suggest that people have overlooked their critical role in encouraging biological diversity and overestimated their impact on our own economic interests. For example, many grazing animals, including domestic cattle, actually prefer to graze within prairie dog towns. The reverse is also true: prairie dogs will preferentially colonize areas that have been overgrazed as they prefer areas with low vegetation that allows a clear view of potential predators. Virtually nothing is known of the frequency or severity of injuries to animals or humans caused by stepping in burrows.

Exclusion

Fencing is generally not practical to exclude any of these animals, except in special cases. Hardware cloth (one-quarter- or one-half-inch mesh) can be buried vertically to a depth of eighteen to twenty inches around small plots of ornamental plants or individual trees. One municipal ballpark laid surplus woven wire mesh fencing over an entire playing surface, and then covered it with soil.

This illustrates the imaginative thinking that can be applied to conflicts between people and wildlife.

Habitat Management

Whether people move into the animals' habitat or the animals come to them, conflicts around developed areas generally are greatest where human-altered landscapes (such as lawns, golf courses, playing fields, and gardens) are affected. If we commit ourselves to maintaining or restoring as much of the natural landscape as possible, conflicts with these animals would likely be minimized.

Changing habitat, mainly by changing landscaping, can increase or decrease cover or available forage or encourage predators. Before making major landscaping changes, determine what species of ground squirrel or prairie dog is on your property and do a little research on its preferred habitat. It is particularly important to determine whether the animal you are hosting *seeks* tall vegetation for cover or *avoids* it because it blocks the view of approaching predators. Once you learn what habitat the species on your property prefers, you can decide how to make the habitat less desirable to that animal.

Black-tailed prairie dogs actively clear vegetation to keep the view open so they can see predators from a distance. Other species, such as the thirteen-lined ground squirrel, seek out areas of low vegetation but may not actually clip vegetation themselves. For these species, you can create a visual barrier along the edge of colonies, blocking the line of sight. This can limit the spread of a colony or even force an existing colony to relocate.

The barrier, whether temporary or permanent, must not allow much light through and can be made of vinyl barrier fencing, snow fencing, a wood-slatted privacy fence, or even hay bales. You can also create a visual barrier of tall sturdy vegetation, such as fast-growing tall grasses, shrubs, or even trees, whether this means establishing new plantings or simply allowing existing vegetation in grassy areas to become taller and denser by mowing and clipping plants less frequently. Because black-tailed prairie dogs will actually clip vegetation that is taller than their preferred height, you may want to begin with vinyl barrier fencing or hay bales, with tall vegetation planted behind it. The fencing will degrade over a few years, but by then the tall plants will be established and difficult for prairie dogs to simply clip down.

This method may have little or no effect on other ground squirrel or prairie dog species. For example, for California and Belding's ground squirrels, it may be better to remove brush piles or rocks, near which these species tend to dig their burrows.

Understanding the role native predators can play in helping to reduce colony size and tolerating their presence can go a long way toward establishing balance that minimizes problems. To provide better habitat for raptors such as hawks, owls, and kestrels, you can provide appropriate-size nest boxes and artificial perching sites near the colony.

Repellents

There are no repellents currently registered for use on these animals.

A Last Word

Habitat destruction and degradation from agricultural and urban development, fire suppression, and overgrazing; massive poisoning campaigns; recreational shooting; and bubonic plague have reduced many prairie dog and ground squirrel species to tiny, isolated populations separated by large stretches of unsuitable habitat. They have been eliminated from much of their historic ranges. For example, black-tailed prairie dogs once occupied an estimated 99 to 245 million acres throughout the Great Plains; today, their range has been reduced by 98 percent. The Washington ground squirrel is now found in less than 25 percent of the sites it once occupied in the Pacific Northwest. For some people such enormous losses are not enough, and virulent attempts to eradicate these animals continue.



Figure 66 *Ground squirrel (generic)*

Such efforts are extremely shortsighted. They ignore the evidence of the minimal negative—and sometimes positive—effects these animals have on ranching, and they misunderstand the important role they play in their ecosystems. Prairie dogs and ground squirrels provide food for predators, such as raptors, coyotes, and badgers, as well as shelter for other burrowing animals (e.g., burrowing owls or rabbits). Their digging and foraging activities have subtle but profound effects, such as aerating soil, increasing soil fertility, promoting nitrogen uptake by plants, increasing the water-holding capacity of soil, influencing plant species composition, and bringing buried seeds to the surface, where they may germinate. State and federal wildlife agencies are only just beginning to respond to the danger to many ground squirrel and prairie dog species and the potentially ecosystem-wide ramifications of their loss. In fact, the near extinction of the black-footed ferret (*Mustela nigripes*), a species that depends solely on prairie dog colonies for food and shelter, was primarily due to the eradication of large prairie dog colonies.

Resources

We recommend J.L. Hoogland's *The Black-Tailed Prairie Dog: Social Life of a Burrowing Mammal* (University of Chicago Press, 1995) as a good general introduction to the behavior and life history of a representative member of this group. Hoogland has edited a book that addresses the conservation of prairie dogs and their ecosystem, *Conservation of the Black-tailed Prairie Dog: Saving North America's Western Grasslands* (Island Press, 2005).

A growing number of nonprofit and volunteer groups advocate for prairie dogs and their ecosystems through education, outreach, and hands-on conflict mitigation. For more information on current programs and how you can get involved, visit the prairie dog coalition website: *www.prairiedogcoalition.org*.

31

RABBITS

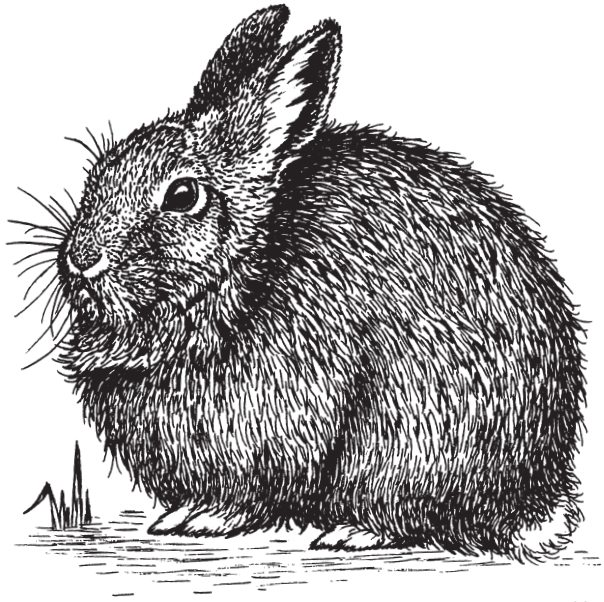


Figure 67 *Rabbit*

"TIMID AS A RABBIT" is sometimes used to characterize people not given to direct or bold action (Figure 67). This may not be a good analogy, however, considering that timid people rarely if ever have to worry about being at the bottom of a long food chain. "Circumspect as a rabbit" might be more apt, because rabbits go to extremes not to advertise their availability as food. As those who keep them as pets know, few animals are as content to sit unmoving for as long as rabbits. This is not to say that rabbits don't let their guard down once in a while. The observant homeowner, if he's lucky, may see rabbits on his lawn in the early morning or evening hours in spirited and spontaneous chases that demonstrate a playful nature rarely observed in most other animals. Rabbits undoubtedly live lives that are full of concern and fear, but it seems they still have time to express a joie de vivre that we can learn from.

- **As rabbits prefer edge habitat, planting warm season grasses and wildflower meadows near a hedge or woods will distract them from other plantings.**
- **Rabbits can leap ten to fifteen feet and, when being pursued by a predator, often jump sideways to break their scent trail.**
- **Anywhere rabbits abound is called a warren—the word originally referred to those places officially granted by the English king for raising rabbits.**

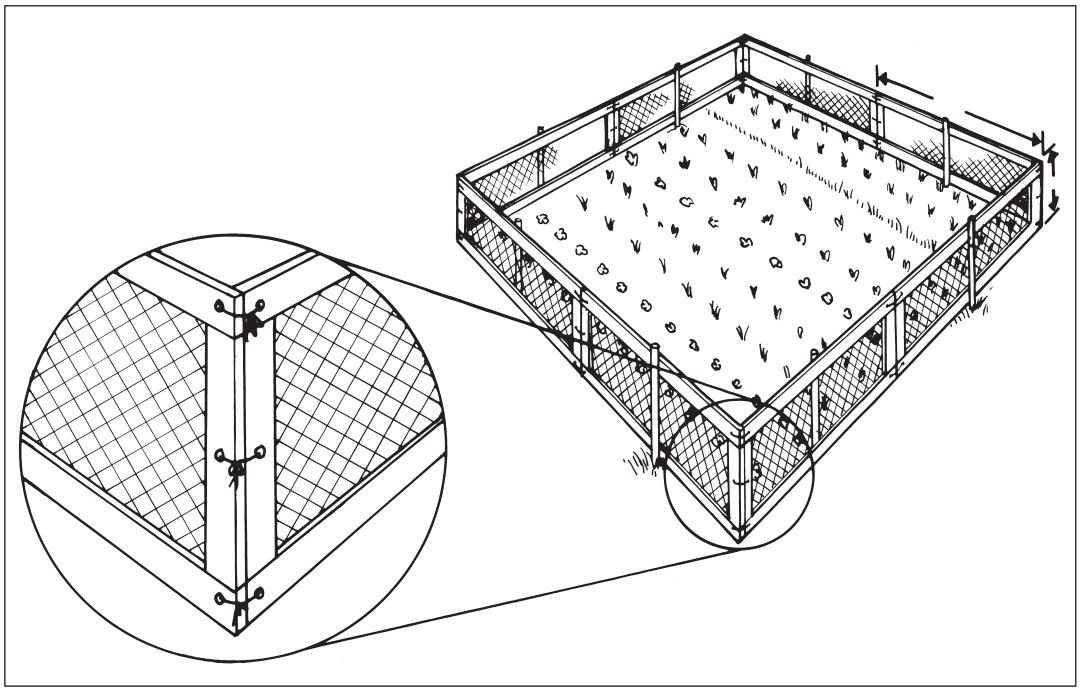
Classification and Range

Rabbits are commonly misidentified as rodents; however, they are actually lagomorphs, a distinct taxonomic group that may have first appeared as far back as thirty million years ago. Lagomorphs are found in both the Old and New Worlds. The New World forms include true rabbits, belonging to the genus *Sylvilagus*, and the hares or jackrabbits that belong to the genus *Lepus*. Rabbits primarily cause problems in yards and gardens, while hares and jackrabbits can be a source of conflict on farms and open range. Wild and domesticated rabbits are often thought to be the same species, but the rabbits we keep as pets belong to *Oryctolagus*, another genus entirely, and are only distantly related to their wild American brethren.

The rabbits and their close relatives make up ten species in the United States, with the eastern cottontail (*Sylvilagus floridanus*) being the most widely distributed and familiar to most people. Eastern cottontails have been introduced to the Pacific Northwest and are widespread enough throughout the South and Midwest to make the descriptor "Eastern" somewhat misleading. Cottontails vary in color from gray to brown and have large ears and hind feet (which also function as heat regulators, since rabbits don't pant or sweat) and short, fluffy tails. Although cottontail species vary in size, they are all rather small animals, averaging about a foot in length and two to three pounds in weight.

Habits

Rabbits are generally found in brushy hedgerows and along the edges of wooded areas with dense cover, but they also do very well in suburban and urban areas, where lawns, gardens, and shrubs meet their habitat requirements. Besides the plants essential to their diet, rabbits need safe resting places and cover in which to escape from predators. Briar patches are a real attraction to them, because the dense, prickly growth of raspberry or other thorny shrubs provides excellent protection. The early successional habitat that rabbits seem especially to favor is often referred to as "old field."



LORI BAKER

Figure 68 *This simple fence, made up of panels that can be stacked and stored in the garage, will keep rabbits from the garden under most circumstances.*

Rabbits feed on leafy plants during the growing season and the buds and bark of woody plants in the winter. Both garden plants and ornamentals can be damaged by their feeding activities, and smaller trees, especially fruit trees in newly established orchards, can be badly damaged by bark girdling in bad winters or when high numbers of rabbits are present. Rabbits are most active at dusk and dawn, a pattern termed crepuscular.

Famous for their reproductive abilities, cottontails begin breeding in January in Alabama and by late March in Wisconsin. Gestation is about twenty-eight days. Three or four litters of three to five, sometimes as many as eight, young ("bunnies") are born each year. Young are born helpless in a shallow depression lined with grass and mother's fur. They grow rapidly and, by two weeks of age or so, leave the nest, when they are less than half the size of the adult. Many young rabbits are "rescued" by well-meaning individuals assuming that, because they are so small, they are still dependent on their mother. Once their ears are standing upright, however, cottontails are old enough to be on their own. They may live up to two years in the wild, but where predators are numerous, they seldom live to be more than one.

Public Health Concerns

Rabbits can be infected with tularemia, which may be transmitted to people if they eat undercooked, infected meat or handle a sick animal.

Problems

Rabbit damage is almost always the result of feeding activities. Rabbits eat flower and vegetable plants in spring and summer and the bark of fruit and ornamental trees and shrubs in the fall and winter. Twigs browsed by rabbits may be identified by their neat, clipped appearance (plants browsed by deer appear ragged and torn) and the nearly spherical pea-size (one-quarter-inch) droppings scattered around the area or sometimes left in small piles. Deer scat, although similarly shaped, is substantially larger than rabbit scat. The easily recognizable tracks of rabbits may also be found in soft soil or snow. Of course, the rabbits themselves may be seen—a dead giveaway to their presence.

Solutions

Tolerance

Here today, gone tomorrow is one way to describe rabbits in suburbia. Given the many predators who make meals of rabbits, their populations can rise and fall dramatically over the course of a year. Sometimes, by doing nothing about their presence and letting nature take its own course, the homeowner sees the same result as would come from investing a lot of time and resources in hiring a service to conduct rabbit "control." Besides, unless it is a prized petunia or a row of young peas that has been clipped, is the rabbit sitting in the yard and helping himself to young dandelions really doing any harm?

Exclusion

The most effective protection from rabbit damage is a well-constructed fence (Figure 68). Chicken wire supported by posts every six to eight feet is strong enough to exclude rabbits. Fences normally need to be only about two feet high. It is important to make sure the bottom is staked securely to the ground to prevent rabbits from pushing their way underneath it. Some gardeners prefer movable fence panels with solid wood frames that can be stored as sections (two by eight feet being one recommended size) and set out to protect the garden right after the first planting, when damage is likely to be most severe. Some years, the panels may not be needed at all, given the ups and downs of rabbit populations. New plantings can be protected by placing over them plastic jugs that have had the bottoms cut off. This doubles as frost protection, too.

Tree Protection

Barriers such as commercial tree wrap or plastic tree guards may prevent bark damage by rabbits. Cylinders of hardware cloth (usually self-supporting) or poultry wire (which may require some staking) can work as well. Place these barriers around the trunks to a height equal to the expected snow depth plus eighteen inches. Young trees and saplings are more vulnerable than are old trees with thicker, tougher bark. Low-hanging branches may also be within reach of rabbits and should be included inside the barrier if possible. Routine pruning done in the fall can provide a decoy food source for the rabbits if trimmings are left on the ground. Rabbits prefer twigs and buds to the bark of the trunk and will concentrate their feeding on these if they are reached easily.

Repellents

If fencing is impractical, or damage is so slight that a fence is not cost effective, chemical repellents can protect small plots and individual plants. Care should be taken not to use a repellent on plants that will be eaten unless it specifies on the label that it is safe to do so. Gardeners have tried many homemade repellents, with the usual varying results that haunt anyone trying to make real sense of them. These include soap and hair, as is sometimes recommended for repelling deer. While we cannot endorse any of these procedures enthusiastically, they may be worth trying and certainly are an inexpensive form of entertainment for the homeowner, and, perhaps, for the rabbits as well.

Scare Devices

There are claims that empty soda bottles buried up to their necks and placed along a garden perimeter produce a noise when the wind blows across them that scares rabbits away. (What happens when it is not windy is unclear.) Under some circumstances, scare tape or balloons might frighten rabbits away from an area. The pinwheels sold to repel moles might provide a visual deterrent to rabbits as well.

Orphan Rabbits

Baby rabbits are fed by their mother only twice a day—at dawn and dusk. Therefore, baby rabbits found alone in a nest are usually not orphans. If the nest has been disturbed, reassemble it and cover the babies with the grass that originally covered them. To check if the mother is coming to care for them, place several lengths of yarn (small branches work, too) in a grid pattern over the nest. If the grid pattern has been disturbed following the next dawn or dusk, you may assume that the mother is still caring for the youngsters.

Habitat Modification

Removing cover (vine thickets, tall grass, and shrub cover) around gardens and orchards can help reduce damage from rabbits by denying them escape cover. Before going to such efforts, however, the potential negative effects on other species, such as nesting birds, should be weighed.

Predators

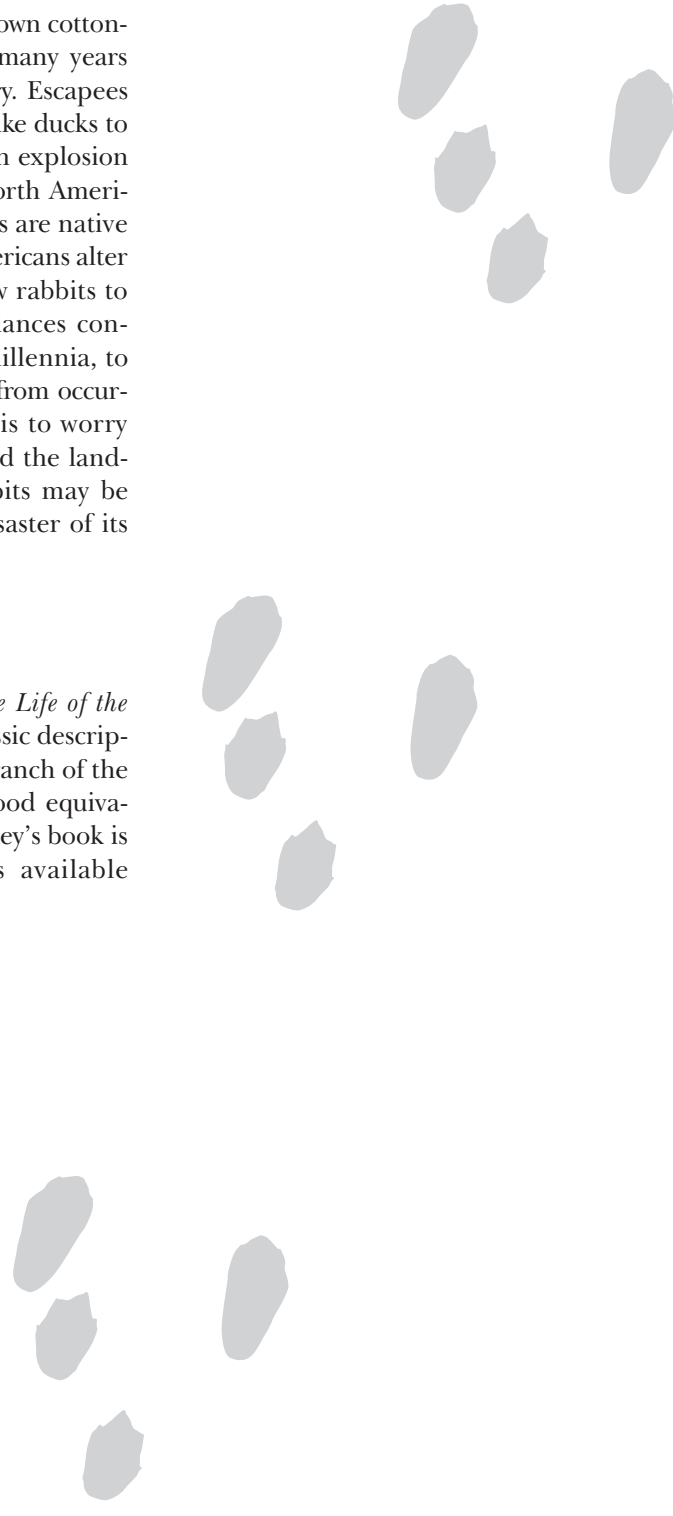
It is important to recognize the role that predators play in keeping rabbit numbers in check. Hawks and owls are important avian predators, and foxes, raccoons, skunks, and opossums are mammals that prey on rabbits. Domestic cats and dogs take a toll on local rabbit populations as well, as do lawnmowers and the automobile. We now know that predation usually does not completely control prey populations, but the bigger idea here is to regulate the "problem" species by natural means to a level where other damage control techniques are more effective.

A Last Word

The English rabbit, cousin to our own cottontail, was introduced to Australia many years ago to start a rabbit meat industry. Escapees took to the Australian landscape like ducks to water, and the ensuing population explosion became an ecological disaster. North Americans are fortunate that our rabbits are native species. No matter how much Americans alter our landscapes in ways that allow rabbits to increase, natural checks and balances continue to work, as they have for millennia, to prevent an Australian-type event from occurring. Indeed, if there is any crisis to worry about, it is that we have so altered the landscape that, in some places, rabbits may be threatened with extinction—a disaster of its own kind.

Resources

Ronald M. Lockley's *The Private Life of the Rabbit* (Avon Books, 1975) is a classic description of the life of the European branch of the family; U.S. residents have no good equivalent yet for our own natives. Lockley's book is now out of print but remains available through online booksellers.



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Raccoons

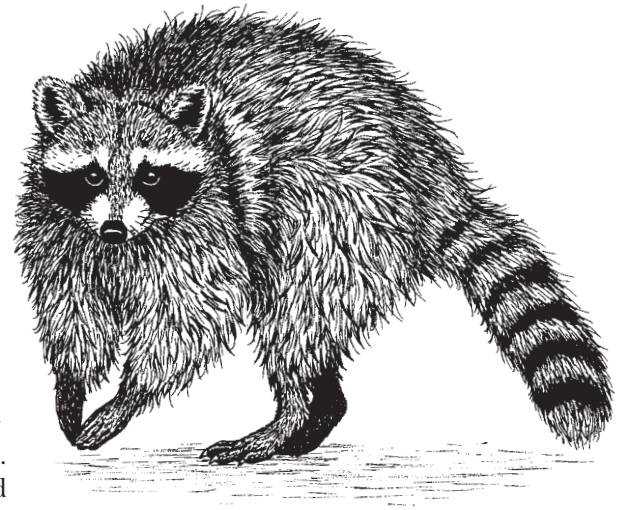


Figure 69 *Raccoon*

With their bandit's mask and ringed tail, raccoons are familiar to just about everyone, even if their nocturnal habits mean they are infrequently seen (Figure 69). Raccoons are one of the best examples of a wild animal that seems to have benefited from contact with humans. We raise crops for them and build structures in which they can take refuge. We have even installed an underground transportation system for them in cities—the storm sewers through which they travel at night and in which they often sleep by day. These animals are true generalists, able to tolerate widely different habitats and live on many different foods.

Requests for help with raccoons and squirrels make up the bulk of a growing business in urban-wildlife control. Raccoons den in attics and chimneys, dig up lawns, and tip over garbage cans, making them unwelcome in many neighborhoods, despite the fact that the troubles they get into are often unintentionally "invited" through our own actions. Whatever might be said about them, raccoons are here to stay, so we ought to enjoy occasional glimpses, resolve the occasional conflict humanely, and make peace with the permanency of their presence as wild neighbors.

- **Raccoons are North America's answer to non-human primates: tree-based, dexterous, and highly intelligent mammals who spend a lot of time trying to work around that clumsy primate—us.**
- **The famous washing behavior of the raccoon is more of a tactile orientation than a cleaning operation. These animals learn about their food by manipulating it with their hands.**
- **Far from being the oft-described solitary animal of popular literature, raccoons seem to be highly social and organized at different levels in kin-based groups.**

Classification and Range

Raccoons (*Procyon lotor*) are truly New World animals, part of a larger family that includes several South American relatives, as well as the ringtail "cat" (*Bassaricus spp.*) and coati (*Nasua spp.*) also found in parts of the United States. Quite modern-looking raccoons (at least their skeletons) are found from deposits dating close to a million years old. Today they are found in almost every major biome (habitat) throughout the forty-eight contiguous states and have made recent inroads into southern Canada as well. Many species and subspecies are reported, but the taxonomy of the group badly needs a modern revision.

The raccoon may be two to three feet long from nose to tip of tail. The average adult male usually weighs no more than ten to fifteen pounds; females are even smaller, typically somewhere between six and twelve pounds. Raccoons in the northern parts of their range may be much larger, exceeding sixty pounds, as will animals who have been fed (or overfed) by humans. Coat color varies from dark, almost black, to sandy or pale. Although sometimes less noticeable on pale animals, the mask and ringed tail are the hallmarks even casual wildlife observers know best. Raccoons are probably color-blind, although they have excellent night vision. Their eyes sometimes reflect light in a greenish glow at night, while the eyes of fox and deer appear more yellow.

Raccoons are at least as intelligent as cats or dogs and far more dexterous. In fact, their sense of touch may be even more developed than their other senses. The scientific name of the raccoon refers to the "washing" behavior, once thought to be instinctive and mandatory in these animals. They manipulate food, dunking and soaking it when water is available, and so appear to be doing laundry. When water is not available, however, they handle food with much the same motion, suggesting that this activity is more a tactile exercise than a cleaning one.



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Figure 70 *The flimsy insect screen has been pushed aside as a raccoon has moved into this attic. Eviction with a one-way door and replacement of the screen with material sturdy enough to prevent another intrusion is called for here, not trapping.*

Habits

Although they prefer mature woodlands, raccoons adapted long ago to almost every natural habitat in North America, except those where water is scarce. They thrive along seashores and in marshes and swamps as well as in woods. Their range is expanding as they exploit sheltering opportunities that human beings provide, from barns in prairies to sewers in cities. Cities and suburbs provide both natural foods and abundant castoffs from human tables. Raccoons frequently find shelter in uncapped chimneys, in attics, under porches, or in outbuildings along back alleys (Figure 70). Raccoons will use their old standby, the hollow tree, if available, even if it is right next to a busy street. In addition to shelter, sewer systems provide extensive travel corridors for raccoons when these are not too flooded.

A raccoon's diet is so highly varied that it almost seems easier to describe the foods he doesn't eat, rather than those he does. Small pieces of tinfoil, newspaper, and even an occasional cigarette butt in raccoon scats testify to their use of human refuse (Figure 71). The mainstays of their diet, however, are fruits, vegetables, high-energy mast foods such as acorns, and earthworms in early spring, when other foods are scarce. They eat fish and aquatic ani-



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Figure 71 *The presence of raccoons sometimes can be evidenced by the neatness they exhibit in exploring unprotected trash. Being highly manipulative and manually oriented, the raccoon often just reaches into the bag, finds, and removes edibles without spreading the contents all over the yard.*

mals, such as crayfish, when available, but many degraded urban streams no longer support these forms of life. Raccoons will eat small animals such as birds, amphibians, and mice opportunistically, but they are not effective or efficient hunters. Their appetite for garden produce, such as grapes and sweet corn, leads to frequent conflicts with gardeners.

There is often a seasonal pattern to raccoon feeding activity. In the Mid-Atlantic states, for example, an early-spring diet of insects and earthworms is followed by meals of mulberry, the first of the ripening fruits. The summer diet follows the order of ripening fruits: blackberries, cherries, grapes, and, last, persimmons in late fall. Between September and the end of December, raccoons gorge themselves on whatever fruits remain, along with acorns, which are a staple. They add as much as 30 percent to their summer body weight before the start of winter, building up critical fat reserves on which to live during the coldest periods of the year. In severe cold, or when deep snows are on the ground, raccoons will remain in dens in a state of general torpor for days on end. They do not go into a deep state of hibernation, however, as do woodchucks.

Raccoons are usually active at night, although along coastal areas they are often active at low tide, when the gleaning is best, regardless of the time of day or night. By day raccoons usually retire to dens or resting sites. Dens are made aboveground in tree cavities, chimneys, and attics, and underground in old woodchuck burrows, storm sewers, or crawl spaces under buildings. When they feel secure enough, raccoons may simply lie in bramble thickets. Raccoons may also commonly share den sites; wintertime dens with more than twenty animals have been found.

Raccoon population density is typically higher in urban and suburban areas than elsewhere, with as many as one animal for every three acres at certain times of the year. Urban populations, however, seem to suffer a higher toll from diseases, especially distemper, and, in most of the East now, rabies.

Breeding seasons vary from north to south and may also be affected by city dwelling. It is possible now that some births occur during every month of the year. However, the norm in central and northern states is for the mating season to begin sometime in January and extend no later than March, with most births in April or May.

Litter size ranges from one to seven, with three to five the usual. Young are weaned at about two months of age and may remain with the mother through the first winter. Young raccoons may move out of their birth area and travel extensively looking for new homes. This often leads to conflicts with people, as they explore and seek shelter in garages and chimneys, get into the trash, or engage in other behaviors that draw human attention. The most recent studies of raccoons in both urban and rural habitats are beginning to show far more complexity to their social lives than researchers believed existed before. Home ranges overlap extensively in both male and female raccoons, and there is growing speculation that related adult males form bonded groups, perhaps along the same lines that lions do. Adult females occupying an area may be related also, as grandmothers, mothers, and daughters remain together throughout their lives and form the core of the raccoon social group.

Public Health Concerns

The raccoon is one of four wild animals (along with the fox, skunk, and bat) considered to be primary carriers of the rabies virus in the United States, and is, therefore, classified as a rabies vector species. Long present in Florida, raccoon rabies was first documented outside that state in 1977, in West Virginia and Virginia, where it was apparently imported with a shipment of animals brought in to repopulate a hunting area. Large-scale oral rabies vaccination programs have been launched in parts of the eastern and midwestern United States and in Canada. Vaccines are packaged inside fish-flavored baits and widely distributed in raccoon habitats.

Another growing raccoon public health issue is the roundworm (*Baylisascaris procyonis*), which can infect humans who accidentally ingest or inhale eggs passed through raccoon feces. Prevention is the key to this problem. Keeping raccoons out of attics and crawl spaces and supervising young children outdoors to make sure they do not come into contact with feces will help prevent exposure to this parasite.

Problems

Raccoons can cause real damage, as when they invade crops in force, or can be merely nuisances, as when they occupy chimneys or panhandle at campgrounds. They are often blamed for more damage than they actually do, while the neighborhood dogs who have scattered trash come off blameless.

Raccoons using attics or chimneys usually begin to make noise at dusk and are heard again just before dawn, while squirrels are active by day and quieter at night (except flying squirrels, who are nocturnal). Even mice can make considerable amounts of noise, and it is important to verify the source of any unknown scratching or tapping noises.

Solutions

Tolerance

Because raccoons are generally secretive, they do not always alert people to their presence soon enough to allow immediate control measures. Calmly and deliberately encouraging a raccoon to abandon an attic or chimney is far preferable to the frantic and demanding first response people often have on discovering that these animals are present. On the other hand, the first sign of raccoon damage to crops such as sweet corn demands immediate action, because the animal can be expected to revisit the garden and to continue eating the crop as long as it is available.

Eviction

Many situations with raccoons in chimneys and attics involve mothers with litters, since these are often ideal places for them to give birth and raise young. Raccoons are born blind and helpless, but noisy. Frequently the first indication that kits (young raccoons) are present is the persistent chittering noise they make. It will be eight or nine weeks after birth before they venture out of the den, and the mother, as educator and protector, will stay with them for at least several months afterward.

Within their home range, raccoons always have multiple dens, moving freely from one to another unless tied by dependent young to any given one for longer periods. Even then mother raccoons can, and often do, carry their young to a new den if the old one becomes unsuitable. If the raccoon

Raccoons Out by Day

The raccoon seen in the yard during the day is not necessarily sick or dangerous. She may merely be foraging longer hours to support her young, visiting a garden while the dogs are indoors, or moving to a new location.

mother can be persuaded to leave and move her young with her, then the homeowner's goal will be satisfied humanely. If not, a humane wildlife control company can reunite a mother with her young and "relocate on site," the most humane and responsible resolution. The humane options in summary are:

- Leave the family alone for the few weeks that the young are helpless. Monitor until the family moves on their own accord and prevent them from reentering the chimney or attic after they leave.
- Gentle harassment may cause the mother to relocate her litter, but there is always the chance the mother may abandon one or more youngsters in this process. Combinations of aversive stimuli (lights, sounds, and smells) are likely to be more successful than use of one technique alone. The Connecticut Wildlife Rehabilitators Association reports much success placing a bowl of household ammonia under a closed damper along with a blaring radio in the fireplace. It recommends starting this "multisensory deterrence" at dusk, right before the mother's normal activity period.
- Trapping the family almost inevitably will lead to separation and the probable death of the young unless it is done professionally. A professional must use a proven reunion strategy that allows the mother to move the young to an alternate den site at her own pace.
- Some professionals use a "one-way door" to get raccoons out of attics or crawl spaces. These require particular care and sensitivity in their use, given the need to ensure that mothers are not prevented from returning to their litters. To use this technique properly, the young must be old enough and mobile enough to exit through the one-way door with their mother.

Chimney Exclusion

Chimneys should be capped to prevent raccoons and other animals from using them but only after it has been confirmed that no animals are present. The fireplace flue, because it has a horizontal smoke shelf just above the damper, is usually preferred by raccoons, but all flues should be checked and secured, preferably before they are ever occupied. Avoid driving an animal out of a chimney or attic during the day. Being primarily nocturnal, raccoons may be easily confused in daylight, and they are certainly more vulnerable, as they are more likely to encounter people or their pets. Never use smoke or fire to try to "smoke" animals out of chimneys. The mother may abandon the site, but the young can be too immature to climb and will die a horrific death.

Attic and Home Exclusion

Attics, crawl spaces, and sometimes even the void between floors can provide harborage for raccoons. Inspection and monitoring are in order to find where animals are coming from and going to. Where raccoons have been in residence for a long time, and feces have accumulated in an attic or crawl space, take care to avoid exposure to the roundworm eggs described previously. Protective clothing and a dust mask should be worn, and feces should be disturbed as little possible until the raccoons have left. Then, a thorough cleanup is recommended, which is generally best accomplished by a professional service. Obviously, a secure and permanent fix to prevent reentry is in order after the raccoons are safely out. This often means contracting with a professional service.

Occasionally, raccoons enter a house through a pet door and then fail to find their way back out. Our recommendation is to prevent entry in the first place by not having an unsecured—or unsecurable—pet door. Because raccoons can cause considerable damage when they are panicked, it is advisable in such a situation to keep both yourself and the raccoon as calm as possible. Move slowly. If it can be done safely, close doors to other parts

of the house, open windows and doors through which the raccoon can exit, and wait quietly for the animal to escape. If the animal does not leave, call local animal control for assistance. Only properly equipped professionals should attempt to capture and handle live raccoons.

General Exclusion

The only long-term, permanent means of coping with troublesome raccoons is to exclude them from areas where they are unwanted. Raccoons are intelligent animals with routines dictated by their needs; if they cannot get a meal at one place, they will look elsewhere, and they will remember where they can and cannot expect to satisfy their hunger. Many homeowners decide that the only solution is to put out a live trap, catch the raccoon, and destroy or relocate it. Before too long, another raccoon moves into the area, and the cycle begins all over again.

Heavy material, such as wire mesh or sheet metal, is necessary to prevent raccoon entry and to keep the animals out if they are evicted. Where wire mesh is used, at least 16-gauge material (about 0.06 inches in diameter) is generally recommended.

Yard Protection

Raccoons can damage lawns by digging for earthworms and grubs. Recently sodded lawns are the most commonly damaged. Because new lawns have to be well irrigated, lots of worms and grubs collect under the sod, which attracts raccoons and, sometimes, skunks. Often they simply reach under the strips and feel around for their meal, pulling out the grubs and worms without any disturbance. Occasionally they tear up the sod and cause significant damage. On small areas, a hot sauce (capsaicin) repellent may be effective. This is generally a short-term problem that lasts only as long as the watering continues.

Garden Protection

Raccoons readily help themselves to unprotected fruits and vegetables in the garden: among their favorites are grapes and corn. Foraging often occurs just before foods are ready to be picked, so extra vigilance may be called for just prior to harvesting the crop. One possible solution is a battery-operated radio, tuned to an all-night talk show, left out for a few nights with the crop. Single-strand electric fencing can be effective where damage is frequent and raccoons are numerous.

Pond Protection

With the increasing popularity of ornamental ponds, raccoons are finding another attraction to homeowners' yards. Visiting raccoons will catch and eat fish, frogs, or other aquatic life that a homeowner may be trying to raise. They may tear up plants in search of food and generally make a mess of most small ponds once they discover them. Depending on the size of the pond, stacking cinder blocks (the kind with the holes) next to one another in groups of three or four, piling rocks, or sinking sections of ceramic tile (the sort used to line chimneys) creates shelters where fish can take refuge when a raccoon visits. Ponds should be at least three feet deep at places for these shelters to work effectively. In extreme cases, and where it is allowed, deter raccoons from disturbing plants and other unwanted activities by erecting single-strand electric fencing around the pond anywhere from four to eight inches off the ground.

Domestic Animal Care

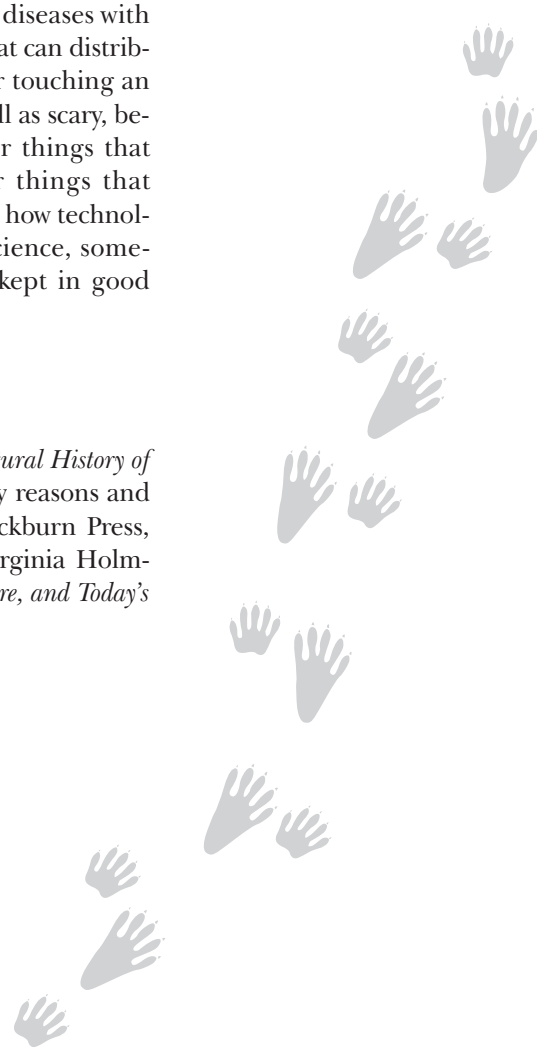
On occasion, raccoons will kill small animals housed outside, such as chickens and rabbits, and they will sometimes get into scraps with dogs and cats. The obvious solutions are not allowing dogs to roam unsupervised and unleashed and keeping cats indoors at all times—practices that are always in your pet's best interest in any case. For their health and safety, pet rabbits should be housed indoors. Encounters between raccoons and pets should be treated very seriously. Consult the animal's veterinarian and local animal-control officials to ensure that pets have either proper disease protection or adequate follow-up to a potential exposure.

A Last Word

The success raccoons have reaped from the changing American landscape comes at a cost to them. Both rabies and canine distemper take a toll on urban raccoon populations. No doubt the species will adapt to these scourges, and natural selection will work in its favor in the long run. In the interim some interesting experiments in disease control are being conducted, such as oral rabies vaccination programs. Our technological capabilities are truly amazing, and every day seems to bring some new potential tool to our attention. In the future there may be ways to immunize wild animals against all sorts of diseases with some very simple approaches that can distribute vaccines widely without ever touching an animal. This is promising, as well as scary, because the technology to deliver things that help animals can also deliver things that harm them. The moral brake on how technology is used is the human conscience, something that always needs to be kept in good tune and fine repair.

Resources

Dorcas MacClintock's classic *Natural History of Raccoons* is our favorite for many reasons and has recently been reissued (Blackburn Press, 2003); another good read is Virginia Holmgren's *Raccoons: In History, Folklore, and Today's Backyards* (Capra Press, 1990).



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RATS

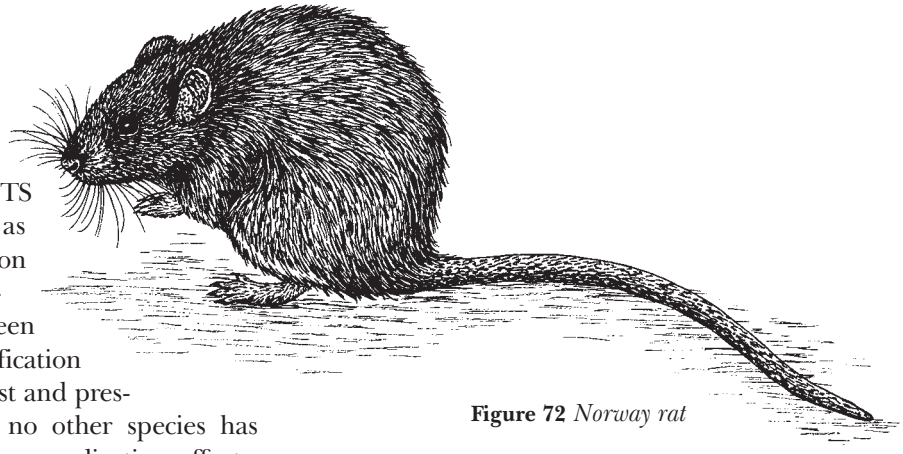


Figure 72 *Norway rat*

OUR CONFLICTS with rats are as old as civilization itself (Figure 72). Perhaps no animal has been a greater object of vilification by human cultures, past and present. Almost certainly no other species has been the object of more eradication efforts, and probably no other has been more successful in holding its own in the face of those efforts, although coyotes and mice might not agree with this last statement. Members of one of the most diverse and successful mammalian families, rats are hardy, intelligent, and (like humans) highly adaptable to changing circumstances. Unknowing carriers of disease and invaders of stored grains, rats do, at times, present real threats to people. The key to controlling problems with rats lies in discovering environmentally and ecologically sound approaches to managing the habitat conditions that sustain them, not in the development of more powerful and dangerous ways to kill them.

- **Agile climbers, rats tend to head upward to flee and can run along a wire as thin as 0.6 inch in diameter.**
- **Black rats construct loose, spherical nests of shredded vegetation, cloth, or other material and usually place them in trees or roofs.**
- **The second most "successful" mammal on the planet, the rat is undoubtedly trying to overcome human beings, now in first place.**

Classification and Range

Rats belong to the family *Muridae*, one of the most diverse families of mammals, with more than twelve hundred species in more than 280 genera. Of the seventy-six species in this family that are native to North America, fourteen are classified as rats in the genera *Neotoma* and *Sigmodon*. The two rats people are most concerned about are the Norway or brown (*Rattus norvegicus*) and the black or roof (*R. rattus*) rat, both introduced from the Old World. Black rats probably arrived in the United States as stowaways with the first European settlers. Norway rats are said to have first arrived in the New World around 1775, when they started their own revolution by displacing their less aggressive black rat cousins. Today the Norway rat has become established almost continent-wide, while the black rat is mostly restricted to coastal areas of the United States.

Physically rats do not appear imposing, but they are incredibly hardy and capable of physical feats that would seem beyond the ability of creatures so small. An opening no larger than a quarter allows an adult rat to enter a building, and rats climb well enough to use a pipe or conduit within three inches of an outside wall to gain access at any level. Rats can jump as high as three feet and as far, horizontally, as four feet. They are excellent swimmers, and the tales of Norway rats emerging in toilet bowls after swimming up through plumbing, while rare, appear to be true.

The Norway rat is slightly larger than the black rat, averaging ten to sixteen ounces, while its smaller cousin runs between eight and twelve ounces. Black rats are more slender than Norway rats and have more pointed muzzles and larger eyes relative to body size. The Norway rat's tail is shorter than its head and body combined, while the black rat's is longer.

Habits

Norway rats are found almost everywhere people are, but they are most common where older urban buildings and trash management problems make shelter and food readily accessible. Neither Norway nor black rats seem to do well in more natural areas where competition with native wildlife may be higher, but this does not mean they cannot or do not make themselves at home in a variety of urban and suburban residential neighborhoods (Figure 73).

Rats are omnivorous: they will eat a wide range of plant and animal foods. Adults require about one ounce of food a day and need access to water. In the winter seed spilled from bird feeders can be an important source of food, as can pet food left outside. Norway rats tend to eat more animal matter than do black rats and consume insects, meat refuse, bird eggs, and even smaller mammals, such as mice.

Rats breed year-round, although peak breeding occurs during the warmer months. Rats reach breeding age at about three months, and average litter size is eight. Young are born naked and helpless but are usually weaned within a month's time. One female can wean about twenty young a year. Life expectancy in the wild is a year or less for *R. rattus* and about two years for *R. norvegicus*.

Norway rats prefer to live in burrows that are usually around eighteen inches deep and three feet long. Burrow systems may have multiple openings that, if possible, are placed so the entrance abuts a solid structure, such as a building foundation, sidewalk edge, rock, tree root, or other physically stable platform. Some entrances serve as escape or bolt holes and may be loosely closed with soil or located in dense vegetation to foil easy detection. The main entrance is usually marked by a well-worn path leading up to it. In buildings Norway rats live inside walls, under stacked lumber or other construction material, and anywhere human clutter is allowed to build up. They are strong swimmers and take readily to water.

Black rats are accomplished climbers and are found in the upper levels of buildings more often than Norway rats. They often build loose, spherical nests of shredded material in trees or in vines well above the ground.

Rats are wary of new objects (neophobic) in their environment, which makes them difficult to trap. Norway and black rats use areas of about seventy-five to five hundred feet in diameter as a typical home range, although this might vary greatly, depending on the location and availability of necessary resources, such as food. We know that Norway rats will travel a half mile or more in a single night to reach a reliable food source. Black rats live more off the ground than do Norway rats, nesting in trees and other structures aboveground and using electrical and telephone wires to move about as squirrels do. Both species are largely nocturnal, although, as with other urban species, this activity pattern may be adopted primarily to avoid human beings. Rats seen during the day are said to indicate a high population density. Possibly these are juveniles, forced to risk daytime exposure because they cannot compete with adults at night.

Public Health Concerns

Rats are implicated as carriers or transmitters of more diseases of importance to humans than any other organism, with the possible exception of the mosquito. In the United States, rat bites exceed fifteen thousand annually and often involve very young, old, or incapacitated people. Rat bites should be treated by a physician. Among the diseases that can be spread from rats to humans are bubonic and pneumonic plague, murine typhus, salmonella, leptospirosis, hantavirus, and tularemia.

Problems

Like mice, rats may damage human food more through urine and fecal contamination than by consumption. Burrowing is potentially damaging, although the problem is usually more cosmetic than structural. Gnawing can be a dangerous problem when electrical wires are attacked. Rats can, and do, gnaw through materials as dense as lead pipe, so most wood does not impede them at all.

Solutions

Tolerance

Tolerating the presence of rats is not something people want to consider, nor is it something we recommend, unlike the case of many of the other species described here. Rats and people simply are not going to coexist harmoniously because of the extent and serious nature of their conflicts. This does not mean that society needs to declare open season on rat populations, use inhumane methods to destroy them, and embrace a no-holds-barred approach to managing their populations.

The key to rat control is maintaining conditions that discourage their presence in the first place. It is unclear whether humans have the current capacity (or will) to control rat problems without killing the rats. It is certain that killing should never occur without taking positive steps to assure the same problems do not simply recur soon after control is exercised.



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Figure 73 *To a significant extent, our problems with rodents are ones we create. This is an open invitation to rats, who will always be present in places where humans are careless, sloppy, and negligent in controlling trash. We blame them for their presence when this happens, but the blame should be on us.*

Ultrasound: Does It Work?

Ultrasonic devices are widely advertised in aggressive presentations that purport to relieve homeowners of everything from mice and rats to silverfish. The Humane Society of the United States will not recommend these devices until scientifically valid studies demonstrate their effectiveness. The bulk of scientific evidence to date indicates that they do not work.

Identifying Rat Signs

It is important to recognize the signs that rats leave and what they say about possible rat abundance. Inside buildings droppings make rat presence evident. Gnawed holes up to two inches wide in baseboards or at door frames are signs of long-term occupancy. Rats like to have something touching them as they move about a room and will hug walls for that purpose (the term thigmotaxic describes this). As a result smudge marks will appear where they have left body oils from rubbing. In heavy infestations, rats are often heard in walls and attics or observed during daylight hours. Your cat or dog taking a sudden interest in watching a blank wall can be the first sign of their presence.

Outside, burrows may indicate the presence of rats, although these could be confused with the burrows of other animals, such as ground squirrels and chipmunks. Sometimes "burrows" turn out to be just holes in the ground from some other source. To determine if a suspected burrow entrance is in current use, fill it loosely with soil or leaves and check it in a day or two to see if it has been reopened.

Exclusion

Rats can enter buildings through holes as small as one inch wide. All holes and openings should be sealed with heavyweight material (one quarter-inch hardware cloth or heavy-gauge screening is recommended). Heating vents, often overlooked, should be checked to ensure rats cannot enter through them. Check for gaps where rats could enter wherever electrical conduit, utility, or air conditioning lines enter a building. Copper mesh can plug openings in walls and floors. Caulking or foam sealants can seal openings also; however, because rats can gnaw through them, they work best when combined with wire mesh.

Repellents

A product called Varpel Rope® is registered as a repellent for mice and rats. Its active ingredient is used in making mothballs.

Habitat Modification

Proper sanitation is the most effective and economical way to limit rats' presence. Minimize attracting or maintaining rat populations with these steps:

- Clear debris piled close to buildings to reveal burrows and openings that rats might use to get in.
- Store food in rat-proof containers, such as galvanized cans with tight-fitting lids. Remember that birdseed, grass seed, and other potential foods in garages and buildings frequently attract these animals.
- Store and dispose of garbage properly so that rats cannot gain access.
- If pets are fed outside, leave the food out for a few minutes only, and then remove it.
- Clean up pet feces from the yard daily.
- Remove old wood or debris piles from the property if rats are a problem—these are frequent havens for these animals.

Where rat infestation has been and continues to be a problem around buildings, an L-shaped footer of either hardware cloth or

concrete can be a long-term means of preventing burrowing along foundations. Bury the footer about twelve inches and extend it out from the foundation about another twelve inches. Rats may begin to dig at the foundation, encounter this obstacle, and be unable to dig past it.

Lethal Control

There are no genuinely humane ways to kill rodents, leaving us to discuss methods that are the *least inhumane*. People kill rats with poisons, snap traps, glue boards, and maze-type traps that lead them into drowning chambers. Although good research on these is hard to find, at least when it comes to identifying how humane or inhumane they may be, it seems, based on what we know, that the traditional snap trap and, perhaps, the newer traps that use an electrical charge to stun and kill, appear to be the least inhumane. This does not mean, however, that rats will not suffer with their use: they almost certainly will. Lethal rat management must be undertaken with the clear awareness that the animals will suffer and, most important, that the rats' presence and, therefore, our need to "manage" them, is largely a consequence of our own lack of proper sanitation in our immediate environment.

A Last Word

It's disturbing that the typical response to rat problems is killing the rats, usually by poison or traps, many of which are grossly inhumane. Except that some of the technologies have changed, contemporary rat control seems to vary little from what was practiced in the Middle Ages. The usual consequence of killing rodents to suppress their population is the return, shortly, to the population level that prevailed before, or one slightly higher. If nothing is done to address the underlying cause of problems with rats, then human beings will forever be locked in a hopeless cycle of short-term, lethal nonsolutions.

Resources

S. Anthony Barnett has devoted a career to the study of rats, and his *The Story of Rat*s (Allen and Unwin, 2001) is one of the few general works on these animals that addresses questions about their behavior and natural history. Robert Sullivan's *Rats: Observations on the History and Habitat of the City's Most Unwanted Inhabitants* (Bloomsbury, 2004) is an interesting tale of one person's search for answers about the lives of city rats and the people who pursue them.

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Skunks

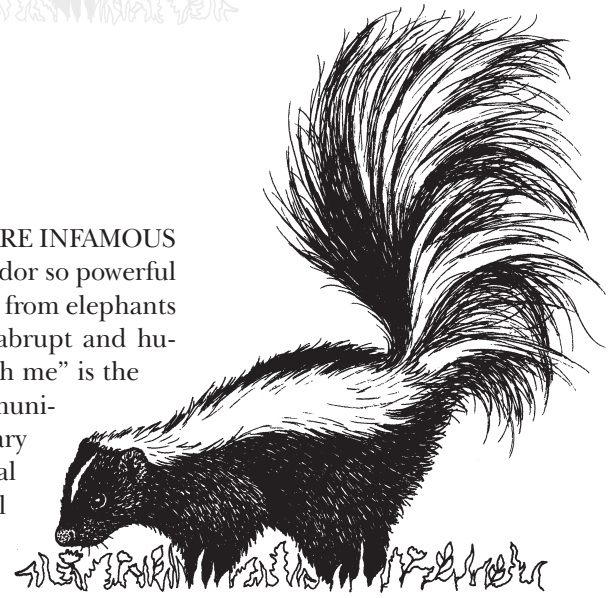


Figure 74 *Striped skunk*

Skunks, of course, are infamous as the producers of an odor so powerful that it brings everything from elephants to cartoon characters to an abrupt and humorous stop. "Don't mess with me" is the message these animals communicate (Figure 74). Their primary defense is a complex chemical musk produced in the anal glands that can be sprayed fifteen feet or more. A person or animal hit in the eyes will experience an intense discomfort that will serve as a reminder of the encounter long after the pain is gone. In fact, the characteristic black and white pelage of the skunk is said to be aposematic, that is, warning coloration that is easily recognizable. The efficiency of this chemical defense, combined with their rather poor eyesight and slow gait, means that skunks often stand and face even large and dangerous threats. This works against most wild animals, who can be dissuaded from attacking, but it is useless against nonrational contrivances, such as automobiles. Consequently, many skunks die on roadways. This is unfortunate, because skunks are placid and retiring animals. They deserve much better press than they usually

- **Striped skunks are able to spray at as young as eight days of age. At this age the skunks' eyes are still closed and they are unable to "aim."**
- **Skunks can spray two or three times without "recharging" their scent glands and need only a half-hour to recharge.**
- **One of the first radio-telemetry studies of skunks followed one animal for three months who was completely blind.**

get because they eat many insects and rodents humans regard as pests.

Classification and Range

Historically skunks were considered members of the mustelid family (*Mustelidae*), which includes weasels, otters, wolverines, and badgers. Recent genetic evidence leads many authorities to suggest that skunks belong in their own family (*Mephitidae*). All skunks live in North and South America. The striped skunk (*Mephitis mephitis*) is the most commonly encountered and widely distributed, living throughout the United States and most of Canada in a variety of habitats.

Spotted skunks (*Spilogale spp*.) are less common than striped skunks and live in much of the United States, except for states immediately south of the Great Lakes and north of Florida along the Atlantic coast (Figure 75). The hooded skunk (*M. macroura*) and hog-nosed skunk (*Conepatus spp*.) are limited to the Southwest. Striped skunks are about cat-size or smaller, weighing between six and fourteen pounds. The little spotted skunk rarely gets over two pounds. Whatever species you encounter, the black and white coloration is a hallmark that communicates the message that this animal is to be treated with respect (even if it takes one or more encounters to learn this salient fact).

Habits

Striped skunks are adaptable to a variety of open, scrub, wooded, and developed habitats. Spotted skunks seem to prefer agricultural landscapes but also inhabit rocky terrain and prairie. Unlike other skunks, spotted skunks are good climbers who can go up and down trees. Normally, skunks do not engage in long travels and have home ranges that typically encompass a few hundred acres. However, within their home ranges, they are nomadic and rarely linger for long in any one spot, except while rearing young. Skunks are primarily nocturnal and usually solitary, except when mothers appear with offspring in tow (Figure 76). Skunks can be active all year, although they remain in dens through the coldest spells in the northern parts of their range, where females, and occasionally males, will share a winter den.

Skunks will eat a variety of plant and animal foods, but they are primarily insectivorous. All skunks will dig for grubs, but hog-nosed skunks are specialists at this task. Of the many kinds of insects that skunks eat, a fair number are pests to humans. Wild fruits and garden vegetables are occasional dietary items. In winter and spring, skunks consume small vertebrates, such as mice, and will take the eggs of ground-nesting birds. Spotted skunks, in particular, eat many rodents. As a true omnivore, the most common skunk, the striped, is also the least finicky eater.

Skunks are capable of delayed implantation, meaning that after mating, the female can store the male's sperm and delay initiating pregnancy for some weeks. Breeding usually occurs in late winter or early spring. Gestation also varies in length, but averages sixty to seventy-five days, so that young usually are born any time from the end of April through early June. Yearling females breeding for the first time often mate and give birth later than older skunks. The western spotted skunk breeds in fall and early winter but, with the longest period of delayed implantation, does not give birth until the following spring. Litters range from three to as many as ten young, who remain in the den for about two months, after which they begin to follow their mother as she forages.

All skunks can dig their own burrows, but when some other animal or human beings have done the work for them, they are content with what is at hand. Favorite den and resting sites include abandoned woodchuck burrows, hollow logs, wood or rock piles, and under buildings, stone walls, hay or brush piles, and (occasionally) trees or stumps. Dens generally are used only for brief periods before the skunk switches to another. These dens may be solitary or communal, depending on the season and the gender of the skunk.



Figure 75 *Spotted skunk*

Public Health Concerns

The skunk is one of four wild animals (including the fox, raccoon, and bat) considered to be primary carriers of the rabies virus and is, therefore, classified as a rabies vector species. Skunks have also been known to carry leptospirosis.

Problems

Skunks are usually announced more by smell than sight. Musk odor may linger for days where a skunk has sprayed. Persistent, faint musk smells under a building or woodpile may suggest that a skunk has taken up residence, although foxes have their own musky scent that may cause misidentification. While foraging for grubs, skunks may dig small, shallow holes in the lawn, similar to those made by squirrels. Occasionally skunks will eat ripening garden crops, including corn. When damage is limited to the lower ears and the plant is not knocked over, skunks could be dining. Poor climbers with weak eyesight, skunks can tumble into window wells and similar steep-sided pits and become trapped. Occasionally a skunk will wander into an open garage or shed, a compelling reason to secure all outbuildings.

Solutions

Tolerance

Occasional skunk sightings in a neighborhood are not a cause for alarm. Given their way skunks will not bother people. They use their powerful defense only when they or their young are threatened and they cannot escape, and even then, only after they give warning. Heed the ample warnings when you encounter a skunk—stamping front feet, a raised tail, hissing, short forward charges, and, especially, twisting the hind end around in your direction. Spotted skunks will even contort into a characteristic handstand, rump in the air with eyes still fixed on the threat. Move away slowly and quietly. Dogs, being dogs, tend to ignore these warnings, so it is imperative that they be restrained for their own good.

It may be hard for people to tolerate skunks living under the deck or an old shed in their yard. But such shelter is what skunks need when they are most vulnerable (during the coldest parts of the winter and when raising young). The nocturnal habits of skunks, their unaggressive and retiring ways, and the generally beneficial role they play in consuming harmful insects and rodents are all good reasons to leave them alone until they have moved on their own accord (which they readily do) or can safely be harassed away from an area where they are not wanted.

Habitat Modification

Preventive measures, such as removing attractants around houses, will decrease the likelihood of an unpleasant skunk encounter. Attractants include garbage and pet food left out at night and convenient denning sites, such as wood and rock piles, elevated sheds, openings under concrete slabs and porches, and access to crawl spaces under houses. Secure trash and feed pets indoors or remove food immediately after pets eat.

Skunks dig for grubs in lawns when wet soil conditions push grubs close to the surface. When the soil dries, the grubs move



BRAD GATES

Figure 76 *This mother skunk is moving her young after being disturbed. She will make one more visit to the old den than there are babies to move, since she is not good at counting.*

deeper, so if you do not overwater lawns, this problem is generally short-lived.

Exclusion

Exclusion techniques should be used proactively to prevent denning before an animal moves in. A suspected skunk den should be checked first to determine if it has a current resident. This may be done by loosely filling the hole (or holes) with soil, leaves, straw, crumpled paper, or similar material. If a skunk is present, the animal will easily push his way out overnight and reopen the hole. If the plug remains undisturbed for two or three nights (and it is not winter, when the skunk may be inactive for long periods), it is safe to assume that the hole is unoccupied and can be filled. Permanently exclude skunks (and other den-seeking creatures) with an L-shaped footer or similar barriers. If a skunk is using the den, either harassment or eviction using a one-way door system is recommended.

Harassment

When it is safe to displace skunks, mild harassment can be very effective. This can be as simple as loosely repacking the den hole with leaves or straw or other material to see if the skunk gets the message and moves elsewhere. Mild repellents, such as used kitty litter, can be placed near or inside the burrow to one side so the skunk has to pass them to get out; commercial or homemade capsaicin or castor oil repellents may also be tried. Adding light and noise to make an attractive (quiet, dark) space unattractive may help. Make sure the skunk is not close by before placing the disturbing stimulus. Apply a couple of hours before dusk, and the nocturnally active skunk should get a strong message.

Eviction

Skunks that have wandered into a garage or shed can simply be allowed to wander back out by making sure the door is open before dusk. You can tell the skunk has left by watching him, or (if you wish to go to this trouble) by sprinkling a band of flour on the floor and checking for footprints heading outside.

A skunk may be evicted from an active den by installing a one-way door over the entrance to allow the skunk to leave but not to get back in. It is imperative to be sure that dependent young are not present. When in doubt, assume they are and consider using the door after they start following their mother to forage. Leave the door in place for two or three nights to a week to be sure the skunk has left.

Repellents

Repellents are advertised and sold to deter skunks from gardens, flower beds, and lawns. Some are the predator urine products that we believe are inhumane and inappropriate for use. Others, such as the powerful capsaicin-based hot sauces, must be used with extreme care because of the consequences for both people and pets who may inadvertently come into contact with them.

Removal from a Window Well

If a skunk becomes trapped in a window well or similar steep-sided pit, provide a means of escape. Place a rough board (or one with cleats, carpet, toweling, chicken wire, or other material to give the animal traction) that is long enough to serve as a ramp out of the well. Skunks are poor climbers, so the board should lean no steeper than a 45-degree angle. Approach the well low enough to be out of sight of the skunk, and then slowly and

carefully lower the board. If possible, a second person with a vantage point high enough to see the skunk (perhaps from an upstairs window) can warn of any signs of agitation. Another method of placing the board is to tie it to the end of a long pole and lower it by holding the opposite end of the pole. Once the board is placed, keep people and pets away from the area until nightfall, when the skunk should leave.

If the skunk cannot climb out due to the well's depth or steepness, the Connecticut Wildlife Rehabilitators Association recommends a technique it uses successfully that involves a plastic rectangular garbage can and really smelly cheese. The cheese is placed at the bottom of the can, which is lowered on its side with the open end facing the skunk, who enters and begins to dine. The person elected to perform this operation carefully tilts the can up a bit, raising it elevator style out of the window well, then gently tips it on its side again so the skunk can amble out. The Connecticut group claims never to have had a spraying incident and always to have been successful using this method, which we pass along for that reason. Regardless of how you end up getting the skunk out, to prevent the situation from recurring, install covers over window wells.

Neutralizing Odors

The traditional remedy for a "skunking" is a tomato juice bath. To really neutralize the smell, however, the chemicals in the spray must be changed into a different type of molecule, and tomato juice does not do that. Tomato juice, vinegar, and any other mildly acidic solution can wash off the oily spray to reduce the smell. People may believe it works, because the human nose quits smelling extreme odors (olfactory fatigue) after a period of exposure and will, instead, smell new odors, such as the tomato juice. To neutralize skunk spray odor on dogs, skin (not eyes), and clothes, mix:

1 quart of 3 percent hydrogen peroxide

1/4 cup baking soda

1 teaspoon liquid soap (laundry or dishwashing soap)

Use immediately, and outdoors, if at all possible, to keep the volatile skunk spray out of your house. Rinse after five minutes and repeat if needed. Do not store this mixture—use it immediately after mixing. (If left in a closed container, the oxygen gas released could make the container burst.) This mixture can bleach fur and hair color.

You can also buy commercial products from veterinary and pet supply outlets.

Clothes or other fabric items sprayed directly may be best thrown away. Fabric that picked up the smell indirectly, as well as buildings and similar surfaces, can be washed with one cup of liquid laundry bleach per gallon of water. (This may bleach colors.) Commercial products containing neutroleum alpha will also neutralize the odor. Liberal flushing with cold water will ease the discomfort of skunk spray in the eyes, but it is best to consult your physician for treatment.

Skunk odors in the house usually can be traced to occupancy beneath or a discharge outside an open window. During courtship, skunks may be more prone to let loose, or lose control, of their normal scent management patterns. There are odor neutralizers on the market that work with amazing effectiveness to eliminate the stray skunk smells that might need occasional attention.

Lethal Control

People will go to extreme lengths to avoid getting sprayed by a skunk, even those who bill themselves as wildlife-control professionals. Among the latter it is sometimes in vogue to kill skunks by injecting chemical solvents, such as acetone (aka fingernail polish remover), into the animal's chest using a very long pole syringe. This keeps the trapper well away from the animal so the skunk is less likely to become agitated and come within range to spray. How solvents kill skunks is not known, but common sense suggests that it most likely would cause significant pain and distress. We strictly advise that unless veterinary science has studied and validated a killing method as humane, it

should not be used in dispatching any animal, domestic or wild. Skunks are at particular risk for all sorts of unacceptable killing methods, including drowning, because people's desire to avoid getting sprayed overrides every other concern.

A Last Word

People remember encounters with skunks, whether or not they are sprayed. It is common knowledge among those who work closely with these animals that it actually takes a lot to get sprayed, although those who do get blasted undoubtedly consider it no sort of honor. How many skunks are killed each year simply because of someone's fear of being sprayed is not known, but it is surely a large number. One hopes that all of us can become better educated about and more tolerant of these animals in the future, recognizing their role as part of the natural scene, even in towns and cities.

Resources

There are amazingly few books devoted to skunks or descriptive of their natural history. We hope that will change.

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SNAKES

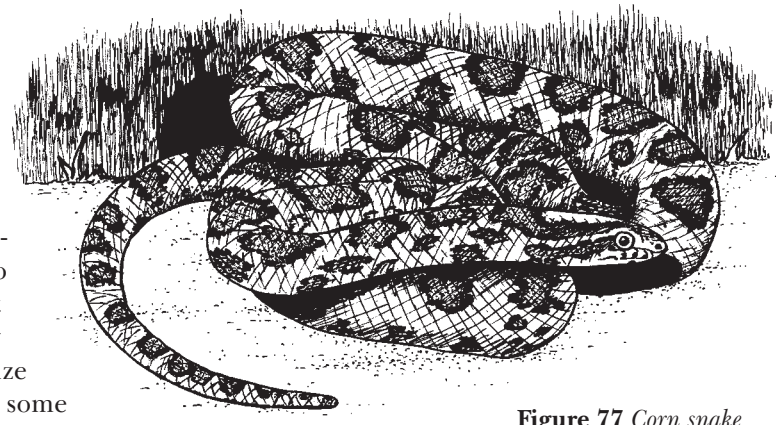


Figure 77 *Corn snake*

SNAKES INSTILL A deep-rooted fear in many people that is associated with few other animals—spiders and bats being examples. Some who study this response believe it is instinctive. In fact, many wild animals clearly recognize snakes as threatening, and some birds and monkeys even have special vocalizations for sounding alarm when a snake is sighted. Small mammals have reason to fear snakes, and all but the very largest animals would do well to be cautious around the few snakes that are venomous. But the persecution of these animals and the acts of violence often committed when even the most innocuous of them is sighted are almost surely a learned cultural prejudice.

- **Despite their know affinity for warm climes, snakes are found in almost every habitat in North America except the Arctic tundra.**
- **People usually encounter snakes in their yards, although these animals occasionally enter buildings in search of mice, insects, or hibernacula.**
- **Some snakes will move considerable distance in the fall to return to traditional hibernation sites; how they remember where these are and navigate to them is not well understood.**

Classification and Range

Snakes belong to the class Reptilia, a group of ectothermic animals (i.e., they do not produce heat internally as mammals do but must rely on external sources of heat to reach a certain minimum before they can be very active). There are about 250 species and subspecies of

snakes in the United States and Canada, each with its own distinct markings, life history, and habitat requirements. Of those that share human habitats on this continent, the vast majority are harmless.

There are two groups of venomous snakes in North America: the coral snakes (Elapidae) and the vipers (Viperidae). The cottonmouth or water moccasin (*Agkistrodon piscivorus*), the copperhead (*Agkistrodon contortrix*), and rattlesnakes (*Crotalus spp*. and *Sistrurus spp*.) are pit vipers (so called for the heat-sensing pits these snakes have below their eyes that are used to detect warm-blooded prey). Reptile field guides and local nature centers can tell you which venomous and common nonvenomous snakes may be found in your area and how to identify them.

Snakes do not hear airborne sounds, but they are very sensitive to vibrations. It is ironic that rattlesnakes cannot hear their own warning rattle, only feel the vibration. They have what amounts to an auxiliary sense of smell by which they use their tongue and specialized organs in the mouth to detect chemical changes. Vision is poor in some species and good in others. All snakes are carnivores, eating small mammals such as mice, insects, small birds, or even other snakes.

Each species of snake has a unique natural history and set of habitat requirements. Snakes must have access to cover, and many species prefer to be close to standing or running water. Wood and brush piles, stone walls, and fields all provide snake habitat. Because food draws most snakes into contact with humans, places where mice and insects abound are most likely to be where human-snake encounters occur (Figures 77, 78, 79).

Public Health Concerns

Snakes are not known to transmit any disease to humans. Nonvenomous snakebites that break the skin should be treated like any puncture wound with a potential for infection, with the consultation of a physician. Victims of venomous bites should stay calm and inactive, if possible, and seek a doctor immediately.

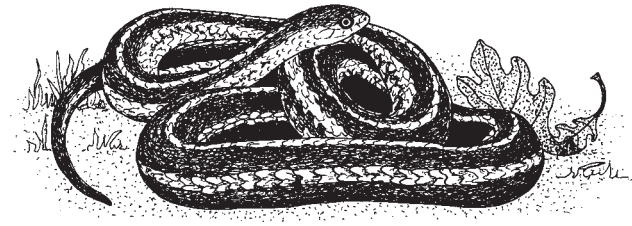


Figure 78 *Garter snake*

Physicians now urge people not to administer first aid for a snakebite—procedures such as cutting open the bite wound and bleeding or sucking can do more harm than good. Snakebites from venomous snakes are rarely fatal, and transport to a hospital, if it can be arranged quickly, is now considered the best response possible. While all venomous snake bites are potentially fatal, the neurotoxic venom of coral snakes is more deadly than the hemotoxic venom of pit vipers.

Problems

Snakes do not cause damage to structures or other property, nor do they eat any plant or crop foods that humans raise. On occasion, some of the larger species cause problems around poultry houses and might take chicks or eggs, but, except for the venomous species, human pets are invariably more of a threat to snakes than snakes are to them.

Solutions

Tolerance

Most encounters with snakes are fleeting. People who enjoy seeing different snakes are often denied this satisfaction for years, so rare have many species become. The first rule for dealing with any encounter with a snake is to leave it alone, identify it by species, and then continue to leave it alone as long as it is not venomous and is not inside a house or building. Virtually all outdoor encounters with nonvenomous snakes should be resolved by letting the animal go its own way. Chances are the snake will never be seen again.

Venomous snakes, on the other hand, are another matter. Encounters with these species

should be taken seriously and the snakes removed to ensure that children, pets, or even adults do not come to harm. This does not mean the snake has to be killed. In many places animal-control or local police or fire departments will respond to these calls and remove the snake. What happens after that may be problematic, since most poisonous snakes have well defined ranges in which resources, such as winter dens (hibernacula), are critical to their survival. Moving snakes into unfamiliar territory may compromise their chances to survive, and thus, at certain times of the year, may be ill advised. Certainly, if an expert herpetologist is available to give advice on a case-by-case basis, then the best decisions can be made about the rare encounters in which snakes must be removed from proximity to people.

Exclusion

Excluding snakes from buildings can be as difficult as excluding rodents. Excluding them from yards or gardens may be completely impractical, although there are theoretically some fence designs that could serve that purpose. Snakes in houses fall into two categories: those who entered accidentally and are eager to find a way out when encountered and those who have entered to find prey or shelter and will take up longer-term residence if allowed. Accidental visitors may come in during floods or be innocent wanderers, who will be trapped inside and likely die from lack of food or moisture if not captured and removed. Among snakes that may become more full-time residents are rat, king, and black snakes in pursuit of rodents living in buildings. Some snakes may hibernate in older houses with accessible cellars or crawl spaces with appropriate microclimates. The presence of shed skin usually indicates that a snake has been living in the house for some time.

When a snake is discovered in a house, remain calm and avoid any act that might disturb him and drive him into hiding. It may be possible to carefully open a nearby door and use a broom to gently herd him out. It may be possible to slowly place an empty pail or wastebasket over a small or coiled snake, then put a weight on top to trap the snake until an experienced handler can remove him. This should be as soon as possible, for both the snake's and the homeowner's peace of mind. If the snake can be confined in a room or corner with barriers such as boards or boxes, he will be accessible to capture when the expert arrives. Snakes are drawn to warmth and darkness, and a heating pad or even a pile of burlap or other material on the basement floor may attract the unwanted visitor, who can then be trapped and handled. If a fearless homeowner knows dangerous from nondangerous species, the snake can be picked up and put outside.

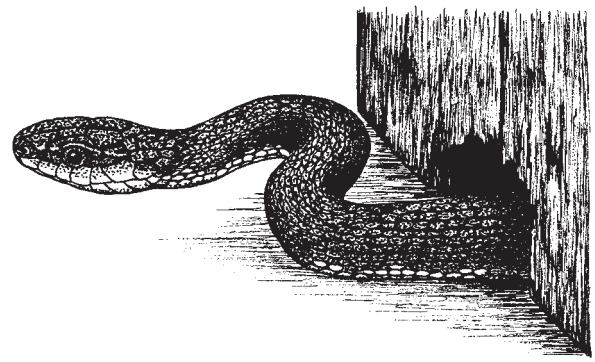


Figure 79 *Black rat snake*

Once the snake has been captured, the homeowner can go on to snake-proof the property. Snakes usually enter a house or other building at ground level, the smallest individuals perhaps through a tiny crack or hole no more than one-eighth inch wide. An intensive inspection of the foundation for unsealed wire or pipe conduits or basement windows or doors that do not seal tightly usually reveals the snake entrance. You should seal all such openings immediately. (The techniques used to deter snakes from entering houses are the same as those used to deter rodents from entering.)

Next, inspect the exterior of the house for possible entrances, particularly at or near ground level. Keep in mind the size of the snake that was discovered and look for any opening large enough for the snake's head to pass through. Many snakes are also good climbers, so check for plantings that may give

access to the roof. A snake may also climb a fieldstone wall or chimney. If such access is present, check for openings around the eaves and roof. Another common place of entry is behind concrete porches or steps or where decks attach to the house.

Once the entire exterior has been inspected and one or more openings have been discovered, decide which opening is likely to be the main snake entrance. Seal all the openings except the suspected main entrance. On that opening, a type of one-way door for snakes can be used (Figure 80). We first heard of it from wildlife consultant Bill Bridgeland: it consists of a piece of aluminum window screen rolled into a cylinder about ten inches long, with a slightly larger diameter than the entrance hole. With the outlet end of the tube suspended off the ground, the tube lets a snake out but not back in, since a returning snake will not be able to find the opening. It may be left in place for a month or longer to allow time for the snake to leave. If the tube is installed in autumn, leave it in place until well into the following spring. After removing the tube, permanently seal the opening.

Habitat Management

Homeowners can minimize the chance of a snake taking up residence in the yard by making the area less attractive to the animal. This means removing potential hiding places for both snakes and their prey, such as piles of rocks, wood, or other debris, tall grass and undergrowth, cracks around concrete porches and sidewalks, and storage sheds with space under the floor. Pet foods and household garbage left outside overnight attract rodents, which, in turn, may attract snakes.

Repellents

There is currently at least one commercially marketed repellent for snakes, and a long list of home repellents, ranging from sisal rope to sulfur, have been claimed to be effective. To our knowledge, no scientific studies have been conducted to prove the effectiveness of any product to repel snakes humanely.

Snakes as Pets

Many people are fascinated by snakes and attracted to the idea of keeping them as pets. Housing and care of these animals can be a relatively simple affair. Many argue that their "lower" ranking in the order of sentient beings indicates that they do not suffer at all and actually benefit from confinement. We don't agree, and we do not recommend that snakes be kept as pets. Our arguments are outlined further in *Reptiles as Pets*, cited below.

A Last Word

In addition to the persecution they experience routinely at human hands, snakes have suffered greatly from the habitat alterations humane beings have created. They and their amphibian cousins fare poorly when people break up natural lands for urban and suburban development and isolate animals who cannot move easily across inhospitable terrain. Many species are either already gone or are rapidly disappearing from urban and suburban environments, and the issue of human-snake conflicts has essentially become moot in many places. Whether some species adapt to the changing conditions wrought by human beings remains to be seen. Certainly they will not do so as long as people's irrational fears are so overwhelming.



JOHN GRIFFIN

Figure 80 *No, this is not a soaker hose. It is a one-way exit for a snake living in this basement. Once out of the basement, he will not be able to figure out how to return, since he is using tactile and olfactory cues that simply do not allow him to determine where the entry hole begins.*

Resources

Joseph Franke and Teresa Telecky's *Reptiles as Pets* (HSUS, 2001) discusses in detail the issues and problems with holding snakes and other reptiles in captivity and why the trade in live reptiles is so injurious to their kind. Desmond and Ramona Morris's *Men and Snakes* (McGraw Hill, 1965) is a classic, in-depth look at the history and psychology of human-snake relationships. For those who are interested in rattlesnakes, Laurence M. Klauber's *Rattlesnakes: Their Habits, Life Histories, and Influence on Mankind* (University of California Press, 1982) remains highly readable and informative.



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SPARROWS

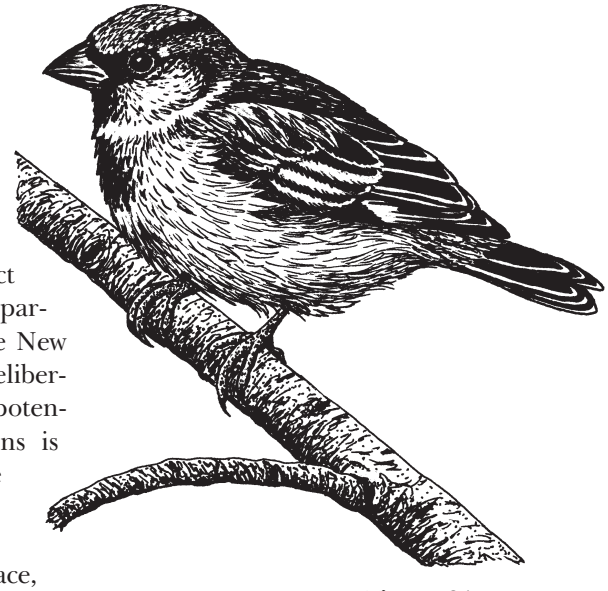


Figure 81 *House sparrow*

THERE ARE MANY DIFFERent kinds of sparrows in North America, but the most widespread—and most often in conflict with humanity—is certainly the house sparrow (Figure 81). It is not native to the New World but rather one of many species deliberately introduced from elsewhere. The potential for harm from such introductions is becoming more recognized, and the house sparrow is often held up as a prime offender. Many bird lovers despise this species because it will displace, outcompete, and even kill native birds.

The good citizens of New York didn't know this in 1852 when, disappointed that their first attempt at introduction had failed, they formed a committee to ensure it would not happen again. They succeeded. Their interest was in solving a cankerworm infestation in city trees (since their concrete jungle had become already too hostile for native bird species that might control these insects), but by the time they realized that sparrows would not only survive but also thrive, it was too late. Other cities had introduced successive waves of sparrows, moved them, even sold them, and had fired up an ecological locomotive that would become a runaway within a quarter-century.

- **The house sparrow is an Old World bird that is only distantly related to the sparrows of North America.**
- **Soon after it introduced house sparrows to the Commons, the City of Boston hired a man to kill the loggerhead shrikes preying on them.**
- **If house sparrows' nests appear somewhat messier than those of most other birds, perhaps it is because they use plastic, paper, and other human detritus in their construction.**

It would be nice to think that this taught the well-meaning citizenry a lesson, but, sad to say, the parade of introduced species continues, even to today.

Classification and Range

The house sparrow (*Passer domesticus*) is one of the most widely distributed animals on this planet. Originally thought to be native to the area of the Mediterranean, house sparrows are now found on all continents except Antarctica and may occupy as much as a quarter of the earth's habitable land surface. House sparrows are not found in Japan or Alaska (yet), but completely wild populations live in the Australian outback, far from any people. In North America they live as far north as the Hudson Bay, where they tolerate long, cold winters. In Asia house sparrows have become migratory in at least two places, while elsewhere they seem content simply to be in residence year-round.

One of the most interesting consequences of the enormous range expansion of this species is significant variation in body size; birds in areas with severe winters are significantly larger that others. This trend, known as Bergman's Rule, is seen in other animals as well.

Habits

Overall, house sparrows have omnivorous diets—they eat both plant and animal (in their case, insect) material. However, adults tend toward being granivorous, meaning they prefer seeds, while the young are fed mostly insects. Many of the insects that sparrows eat are injurious to human interests. These birds probably not only saved the street trees of New York, but even today are beneficial, eating dead insects. Early morning commuters along quiet city streets may notice the small brown birds that dart from the road just in front of them. They are the house sparrows, up early, gleaning the moths and other insects struck by cars the night before.

The enormous quantities of grain used to feed horses in the 1800s led to optimal conditions for house sparrows, and their populations were probably then at all-time highs. As gasoline-powered vehicles replaced horses, the once-abundant food supplies dwindled, undoubtedly leading to population declines for the house sparrow. "Decline" has to be taken as a relative term, because these birds are often so abundant locally that they continue to be regarded as problems in cities and towns.

Depending on geography, climate, and other factors we do not yet understand fully, house sparrow breeding begins any time from February onward, with a courtship so noisy and boisterous it can hardly be missed. As many as nine eggs are laid in one clutch, with four to six the most common. Both males and females incubate the nest. Hatching begins after about eleven days, and nestlings' emergence may be staggered. As a result fledging (leaving the nest to fly) may be staggered as well. Generally the young leave at about two weeks of age, with adults continuing the feeding for several days after. Then they are on their own, as the parents get ready for the next brood. Two or three, and sometimes four, broods are raised each year, usually between spring and late summer.

House sparrows are both cavity and crevice nesters, although occasionally they may build their nests in evergreen trees or vines that cover the sides of buildings. They compete fiercely with native species for access to nesting sites and are known to destroy eggs laid by other birds (and sometimes even to harass and beat adult birds to death). True to their name, house sparrows find buildings to be equally inviting. Dryer vents and contrivances such as window-mounted air conditioners provide ideal crevices for nesting, as is readily obvious with only a few minutes of watching for sparrows coming and going.

Public Health Concerns

House sparrows generally have not been implicated in the transmission of any serious

disease problems to humans, but the potential for them to play a role in transmitting histoplasmosis or salmonellosis is raised occasionally.

Problems

House sparrows do considerable economic damage to grain crops, which has generated plenty of negative press. As many as seventy species of native birds are documented as victims of bullying by house sparrows. Many ornithologists attribute declines in some of the more popular native species, such as the bluebird, to competition with sparrows. House sparrows nesting near windows can be unacceptably noisy for many people, especially because they are likely to begin vocalizing at the very first light. Sparrows crowding and bullying other birds at winter bird feeders deny many bird enthusiasts the opportunity to enjoy other species.

House sparrows don't hesitate to take up residence, transitory or permanent, in warehouses and big-box retail stores that sell everything from tires to cat food. The loading docks of these buildings are usually open to avian intruders, and when this access point is denied, anecdotal reports claim that sparrows will hover in front of the motion sensors that open doors so they can come and go as they wish. Wildlife-control companies are frequently hired to come in after hours and shoot these birds using pellet guns.

Solutions

Tolerance

The minor inconvenience and annoyance caused by house sparrows should be weighed carefully against the consequence of not having them at all. They are often one of the only species that can tolerate the inner-city environment: would people really be better off if cities were empty of them? We might better accept them—and other animal immigrants—as naturalized citizens and mitigate, if not eliminate, whatever problems they are said to cause.

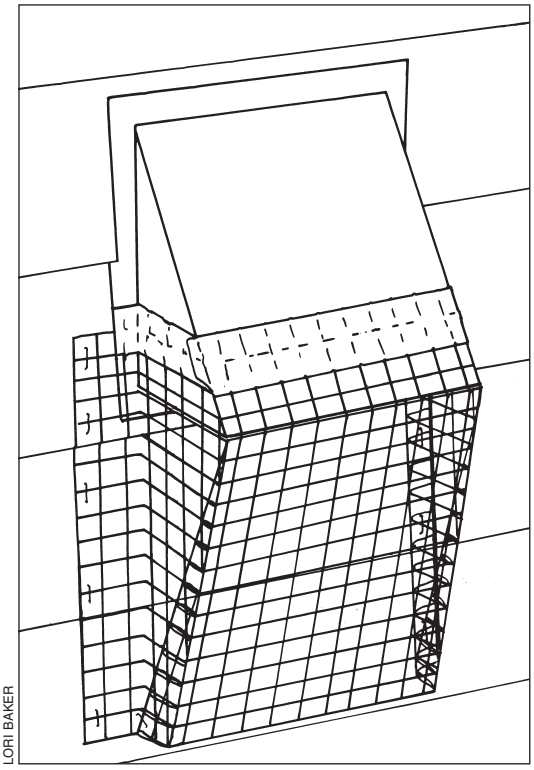


Figure 82 *This homemade screen is covering a dryer vent that was formerly a nesting site for sparrows. You may be able to find commercially made screens in your home improvement or hardware store. If the screen is homemade, it must allow proper venting.*

Exclusion

Because human beings create so many nesting opportunities for house sparrows, excluding them from places where you don't want them is the first, and perhaps best, step in resolving conflicts. The primary tool needed is netting or hardware cloth. The procedure is simple: observe where birds are nesting, wait until there are no young present, remove nesting material, and affix a vent cover to block access to openings (Figure 82).

Where house sparrows are taking over birdhouses and expelling preferred species (wrens, swallows, and bluebirds, for example), an excluder or baffler may work. Timing is important, because house sparrows start nesting before most other species. If birdhouses are taken down in the fall and not put back up until late the next spring, some conflict will

be avoided. Birding enthusiasts discuss the use of monofilament line to deter sparrows around nest boxes, and at least one device based on this principle is sold to deter them from birdfeeders.

Scare Devices

Auditory and visual scare devices effective on other birds typically have less effect, if any, on house sparrows. Scare tape and balloons may be effective if the homeowner wishes to keep sparrows away from specific areas, and apartment dwellers can use them on patios or balconies, along with bird wires, to keep these and other problem birds away.

Habitat Management

One of the principal means of "controlling" house sparrows has to be habitat management. Specific efforts to exclude birds from nesting sites will work, but only if sparrow activity is monitored and nesting prevented at its earliest stages. Conflicts can be avoided by thinking ahead to where birds might nest (including where they nested last season) and denying access. This approach would be especially helpful at the many commercial buildings that seem designed expressly as house sparrow nesting sites.

Controlling access to food is another way to manage house sparrows. Trash management is important, of course, and even the simple act of keeping dumpsters closed can help. Birdfeeders in the yard can be filled with mixtures that do not emphasize the "filler" seeds (usually different kinds of millet) preferred by house sparrows. Your local bird specialty store can recommend which mixtures best attract the birds you wish to see at your feeder.

Evicting Birds from Buildings

All sorts of birds can inadvertently find their way into buildings, but house sparrows seem to have some special proclivity for this. Often they can simply be left to their own devices to find the way back out, if people are willing to be patient with them. Because they fly up and toward light, they may be trapped by skylights or in areas with high ceilings where they may not easily find the opening through which they entered. Nets may not be available or convenient to use, and it is often necessary to develop elaborate strategies to progressively seal off access or frighten the bird from an ever-widening area until the obvious path of exit reveals itself. A useful frightening tool can be assembled quickly by putting a few stones, coins, or marbles in a plastic or metal container and affixing the container to the end of a broom or pole. This can be held aloft and gently rattled to help drive a bird from those higher and unreachable places. Those who manage warehouse-like buildings with recurring bird problems should establish programs to live-trap and remove birds and work to bird-proof the obvious entry points. House sparrows are not a protected species, but that does not mean they should be treated inhumanely.

A Last Word

House sparrows are here to stay. They love urban parks, buildings, industrial areas, farms, and the other house sparrow habitat we create for them. They undoubtedly affect the dynamics of local bird communities, and much of that change may be, at least in the short term, disadvantageous to other species. What will happen over the long haul is anybody's guess. But it may be worth noting that in England and parts of Western Europe, sparrow populations are declining, in some places dramatically. Concerns are being raised there for their conservation. Sometimes you have to be careful what you wish for.

Resources

Two lovely and informative articles can be found in Eugene Kincaid's *Wildness Is All around Us* (E.P. Dutton, 1978) and Helen Ross Russell's *City Critters* (American Nature Study Society, 1968).

The Cornell Laboratory of Ornithology is a science-based organization that, through its Urban Bird Program, advocates understanding of birds such as house sparrows. It dispels myths and advances the understanding that precedes humane approaches to conflicts between people and wild animals. You can hear and learn more about these birds at *http://birds.cornell.edu/BOW/HOUSPA*.

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Squirrels



Figure 83 *Gray squirrel*

Where public opinion has been polled regarding suburban and urban wildlife, squirrels generally rank first in likeability *and* in problematic behavior (Figure 83). Such is the paradox: people want them and they don't, depending on what the squirrels are doing at any given moment. Tree squirrels are arguably the most successful mammal in North America at accommodating to human-altered environments. They owe their success to the same attributes as other urban-ready species—adaptability, hardiness, productive breeding habits, and ability to use human-built environments—but really excel when it comes to being likeable. Not that we recommend it, but stories abound of urban squirrels allowed carte blanche onto balconies and even into homes where they are rewarded, of course, with free handouts.

Their likeability stems from a variety of considerations, not all of which make good objective sense. Their bushy tails are appealing, and because squirrels have large, bright eyes relative to the size of their heads, they present an image that animal behaviorists call pedomorphism. Put simply, the physical appearance of squirrels is somewhat akin to that of babies, kittens, puppies, or similar large-

- **Tree squirrels will nibble on the antlers shed by male deer, especially in late winter, when they crave the calcium these contain.**
- **Squirrels unintentionally "plant" countless trees when they bury acorns and fail to retrieve them before they sprout, thus helping to ensure a continuing supply of the trees they count on for food.**
- **They will not bury acorns with insect parasites in them—their sense of smell is so keen that they recognize these as spoiled and reject them.**

eyed young, and it probably unconsciously warms people to them. Norway rats are similarly built except that their naked tails and small, beady eyes seem to evoke a strong negative reaction in people. (Of course, squirrels also engage in fascinating and endearing behaviors that work to their advantage.) Squirrel watching can be an educational and enriching experience, and, because squirrels are active by day, it is also easy.

Classification and Range

There are an astonishing number of squirrels worldwide, and many are strikingly attractive animals. In North America there are six species of "tree" squirrels in the genus *Sciurus*, in contrast to the even greater variety of "ground" squirrels (genus *Spermophilus*). The fox squirrel (*Sciurus niger*) (Figure 84) and eastern (*S. carolinensis*), and western (*S. griseus*) gray squirrels are the species usually involved in homeowner conflicts. The pine or red squirrels of the genus Tamiasciurus (Figure 85) cause problems similar to fox and gray squirrels throughout their extensive range. Northern and southern flying squirrels (*Glaucomys volans* and *G. sabrinus*) may also nest in buildings near wooded sites and occasionally can cause problems (Figure 86). When they do the same general rules that apply to solving conflicts with gray and fox squirrels are suggested, keeping in mind that flying squirrels are nocturnal, smaller, and can be more prone to invading attics and crawl spaces in numbers.

Squirrels frequently sit with their tails arched over their backs, providing almost complete cover for their bodies. The generic term *Sciurus* is derived from two Greek words that combined mean "shadow tail"—an animal that can sit in the shadow of his own tail. The eastern gray squirrel is about eight to ten inches long and has a bushy tail that's almost as long. Gray squirrels can actually be highly varied in color and range from a rufous (reddish-brown) tint to almost pure white to an all-black or melanistic form. The western gray squirrel is a little longer, on average, and



Figure 84 *Fox squirrel*

heavier than the eastern gray, weighing almost 1 3/4 pounds. The fox squirrel is the biggest of all: it can be as much as fifteen inches long, with a tail almost as long, and can weigh up to three pounds. The color of fox squirrels is as varied as that of the grays, but they tend to be predominantly a rusty yellowish color with a pale yellow or orange belly. On the East Coast, an endangered fox squirrel population from the Delmarva Peninsula is a striking steel gray color.

Habits

Both fox and gray squirrels traditionally depend on trees as places to bear and raise young, take shelter from the weather, find food, and escape from predators (Figure 87). As part of their adaptation to human changes to the landscape, squirrels use almost anything that looks like a tree, including the pilings around marinas, nest boxes set out for birds, and cozy places on and in houses. Squir-



Figure 85 *Red squirrel*

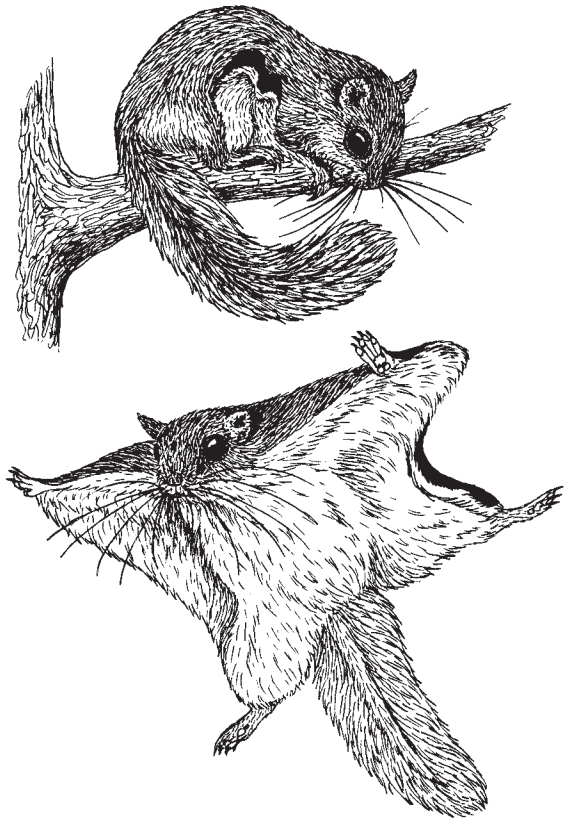


Figure 86 *Flying squirrel*

rels have adapted fluidly to the planted and landscaped "forest" of urban and suburban parks and usually can maintain themselves quite well there. They also do well all by themselves in neighborhoods, but rarely, if ever, will they turn down handouts there as well.

Squirrels' diets vary with the seasons and the availability of the plant material that makes up almost their entire larder. Acorns and other nuts are both eaten and stored underground in the fall and early winter. These underground caches make up a substantial portion of the winter diet. In spring squirrels eat flowers and growing buds on the ends of branches, and it is common to see squirrels busily working high in yet leafless trees at this time of the year. In summer fruits such as mulberries, raspberries, and wild cherries are eaten. Some scientists speculate that this is actually the hardest time of the year for squirrels, more so than spring, when buds are a mainstay, and fall and winter, when nuts are collected and eaten. Squirrels occasionally do take bird eggs or nestlings and may even pounce on and kill small birds at feeders, much to the dismay of human witnesses who might have assumed they were always peaceful vegetarians.

Eastern gray and fox squirrels usually have two litters a year. The first breeding period begins in December or early January, with young born between February and April after a gestation period of a little more than forty days. A second breeding period begins in early summer, with that litter born in August or September. The western gray squirrel has only one breeding season a year, and young are born between February and June.

Courtship features frantic chases, often with several males pursuing one female. After mating the female drives the males away and raises the two to five young by herself. The babies are born naked and helpless and do not venture out of the nest for seven or eight weeks. They are weaned at eight to ten weeks of age (in gray squirrels) or ten to twelve weeks (in fox squirrels). The spring litter is usually driven away by the mother shortly after weaning, just as the next breeding cycle begins. The fall litter may stay with the mother in the nest through the winter until well after the winter courtship season.

Squirrels use two types of natural dens, tree cavities and leaf nests, and take liberal advantage of shelter provided by humans in attics and crawl spaces along the upper floor

of buildings. Leaf nests, called dreys in England, need constant repair and do not provide as much protection from predators and weather extremes as do tree cavities.

Both fox and gray squirrels are active during the day (diurnal). Fox squirrels may spend more time on the ground than grays and have been found to use larger home ranges on average than do grays, although both species have been found to use home ranges as small as two acres and as large as fifty acres or more. Both species have extensive home range overlap between individuals with no evidence of territoriality, although core areas may be defended. Squirrels become active at first light and usually rest in the middle of the day before becoming active again later in the afternoon. These patterns vary, however, depending on weather conditions and other factors.

The most remarkable yearly event for gray squirrels from a human perspective is the "fall shuffle," when the seasonally frenetic activity of collecting, eating, and burying nuts is accentuated by the dispersal of both adults and juveniles, perhaps in search of that "perfect" home site. Automobiles kill many squirrels at this time of year.

Public Health Concerns

Squirrels can harbor pathogens (such as salmonella) of potential consequence to humans, but rarely, if ever, are they documented as transmitting these. Rabies can occur in squirrels, as in any mammal, but squirrel-to-human transmission has not been documented.

Problems

Squirrels may cause damage by nesting in buildings, digging in lawns, eating ornamental plants and bulbs, and stealing food from bird feeders. The most serious problems with squirrels probably involve adult females nesting in a building. They will explore any promising opening while searching for a den site and often enter chimneys or attics through unscreened vents or openings left by loose or rotten boards. Squirrels invariably enter a building somewhere high on the structure and exploit an existing hole, though they may enlarge the hole by gnawing. A homeowner's first sign of the squirrel's presence is usually the sound of scampering in the attic. Squirrels entering chimneys are sometimes unable to climb back out and, in desperation, emerge from a fireplace or get loose in the basement.

Squirrels nesting in attics usually gather insulation into a nest near the entrance and may gnaw on adjacent boards and electrical wires. People typically hear the squirrel during daylight hours as it comes and goes on foraging trips. Juvenile squirrels, and occasionally adults, roaming around the attic may fall into wall cavities and be unable to climb out, making persistent scratching noises as they attempt to escape, eventually dying if they are unsuccessful.

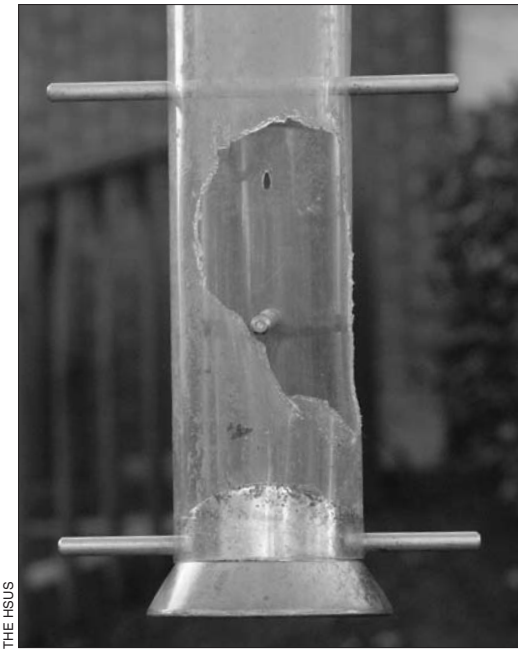
Squirrels often become nuisances at bird



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Figure 87
This branch is a virtual highway to the roof for squirrels. After repeated invasions of the building, the branch was finally trimmed back and squirrel traffic rerouted to nearby trees.

feeders, where they consume large quantities of birdseed or gnaw on the feeders themselves (Figure 88). Squirrels can also damage ornamental plants or fruit and nut trees by feeding on bark, buds, and fruits. Spring bulbs, especially tulips and crocuses, may be dug up and consumed, or the plants may be clipped and eaten just as they start to flower. Squirrels occasionally gnaw on outdoor furniture, wooden decks, and wood trim on buildings. All rodents have ever-growing front incisors that require gnawing to keep them sharp and at a manageable length (Figure 89). If squirrels do not wear down these teeth through eating, they may begin to gnaw on other objects.



THE HSUS

Figure 88 *Most homeowners don't appreciate spending good money on bird feeders only to have the local squirrels eat the seed, and, sometimes, most of the feeder. Contrary to the urban myth that surrounds them, squirrels can be excluded from bird feeders very effectively—which may be why we suggest an occasional handout for them, too.*

Solutions

Tolerance

Sometimes it's easy for people to accept, tolerate, and enjoy squirrels, and sometimes it isn't. No one is pleased when one is loose in the house, and continuous emptying of bird feeders can test normal endurance. It is important to remember, however, that these animals are only doing what is natural to them—seeking release from entrapment or looking for a meal. The first approach to dealing with squirrels is to establish limits of tolerance, accept them for what they are, and be patient enough if they need to be excluded from an attic or prevented from stealing bird food so this can be done in a way that does them and their young no harm.

Exclusion from Attics

Thoroughly inspect inside the attic to find the opening(s) and try to locate the nest to see if babies are present. Concentrate the search in the area where noises were heard. If there is no access to the attic, inspect the exterior eaves, vents, and roof until the opening is located.

If the nest can be seen and no immature squirrels are present, attempt to frighten the squirrel outside by banging on the rafters inside the attic, or wait until you are sure all squirrels have left, which they usually do during the day. Seal up the opening with hardware cloth, securely fastened. Extend the patch at least six inches beyond the hole in all directions to prevent the squirrel from gnawing around it. Seal any other weak spots or potential entrances in the same way. Listen carefully for the next day or so to be sure no squirrel is trapped inside or has regained entry. Watch closely to see if the squirrel persistently attempts to regain entry. Mothers will go to extreme lengths to reunite with their young, and frantic attempts to reenter are usually strong evidence that young are still in the house. In this case, let the mother return and observe whether she moves the litter (Figure 90).

If the nest is inaccessible or out of sight and there is the likelihood of a litter (the squirrel has been in the house for more than a couple of days and it is February through May or August through October), the home-



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Figure 89 *Bird feeders aren't the only things squirrels will chew on as they try to find food. This trash can should be replaced with one that is made of galvanized metal. A handout or two to the obviously motivated and hungry local squirrels might be in order, too, to carry them over the transition from available to not.*

owner may opt to try to force relocation. Any campaign to displace squirrels is best fought on several fronts at once, using an arsenal of weapons affecting sight, sound, and smell. A light left on, a strong-smelling substance such as household ammonia-soaked rags, and a battery-powered radio or similar sound source left on around the clock can overwhelm the squirrel mother and motivate her to relocate her litter. In tight situations, such as crawl spaces between floors, we have heard of success when a vacuum cleaner hose was snaked into the restricted space, reversed to blow air, and left on to unnerve the nester. In all of these campaigns, human presence is an important ally, sometimes sufficient by itself to force relocation. It doesn't hurt to make yourself obvious to the intruder, even to the point of preparing a short speech on the subject of the sanctity of your home, which, if delivered in the appropriate tone of voice, may do the trick by itself.

Trap and Release

Many people think live-trapping squirrels and taking them to "the woods" where they will happily live thereafter is the ideal solution to local problems. It is not. Studies are beginning to show just how few squirrels may survive such procedures and the many different ways they may be compromised by this often well-intentioned procedure. What happens when a squirrel is removed from a yard, anyway? Another squirrel moves in, sometimes within a few days.

Exclusion from Chimneys

Assume that the squirrel heard scrambling in a chimney is trapped unless there is clear evidence he is able to climb out on his own. Never try to smoke a squirrel (or any other animal) out of a chimney—a trapped animal or babies too young to climb out may be killed. If the squirrel is not trapped, the battle tactics described above should be tried to encourage him on him way.

If the squirrel is above, or has access to, the flue damper, a three-quarter-inch or thicker rope hung down the chimney may provide a means of escape. Be sure to tie one end of the rope to the top of the chimney before lowering the other end, and make certain that it reaches the damper or smoke shelf. Be careful not to lower anything into the chimney that cannot be retrieved easily. The squirrel will climb up the rope and escape, usually within a few (daylight) hours. After it is certain that the squirrel has escaped, remove the rope and cap the chimney, preferably with a commercially made chimney cap.

If a squirrel is actually in the fireplace itself (behind glass or a screen), try making enough noise to scare him back up above the damper. If successful, close the damper and proceed as above. If the squirrel cannot or will not leave the fireplace, the next best option is a suitable live trap. Bait it with peanut butter and set it very carefully inside the fireplace. Most squirrels will retreat to a back corner of the fireplace as the doors are opened and stay

there if the trap is placed slowly and quietly just inside the doors. Close the doors and leave the room to wait for the squirrel to enter the trap. As a precaution, before opening the doors of the fireplace to set the trap, close any interior doors in the room and open an exterior door or window in line of sight from the fireplace, if possible. In the event that the squirrel gets out of the fireplace, do not chase him; follow the directions below.

Evicting a Squirrel Loose in the House

A squirrel who entered a house has done so by accident. She does not want to be there and is trying to find a way out. Place any cats and dogs into a room *without* the squirrel. Close interior doors to limit her movement and open a window or exterior door in the room. The squirrel will find the way out if left alone and will even readily jump from a second-story window onto a lawn without harming herself (but don't let her jump onto concrete). If it is not possible to give the squirrel an exit, set a baited live trap on the floor near the squirrel and leave her alone for a few hours.

Squirrels can be captured in a blanket if trapping is not an option. While wearing heavy gloves, slowly approach the squirrel with the blanket held in front of your body, so that she does not see a human form. Drop the blanket on the squirrel and roll it up, taking care not to put too much weight or pressure on the animal. Then take the blanket and squirrel outside immediately and unfurl it, letting the animal escape.



JOHN GRIFFIN

Figure 90 *This commercially made one-way door is set where a family of squirrels has been entering and leaving a house. The young are old enough to be mobile, and all will be safely evicted using this device and prevented from getting back in.*

Once the squirrel is out, discover how she got in the house and take measures to prevent it from happening again. Look for tracks in soot or dust around the fireplace or furnace that may show how she came down the chimney or flue, and check the attic for evidence of a nest or entrance hole that may need attention.

Protecting Bird Feeders

The agility of squirrels makes it difficult to prevent them from reaching bird feeders. It also provides a retirement career opportunity for those with enough time to defeat squirrels' attempts to outthink and outmaneuver their human neighbors. Many homemade solutions to keep squirrels from feeders have been invented and tested, but today there are a number of specialized feeders commercially available that seem to do that job well. Some are designed to respond to the greater weight of squirrels and close a metal cover over the birdseed when they climb onto the feeder; others simply provide a metal cage within which standard tube feeders fit. In fact, it is now possible to buy both a feeder and cage as one unit, and in our experience both of the above designs work perfectly to keep squirrels away from the main source of food. The birds always manage to drop some seeds, so as an added bonus the squirrels get something, too.

Squirrels will also have difficulty raiding a feeder hung from a tree branch on a wire more than ten feet long. The feeder should be positioned at least eight feet away from the tree trunk, limbs, or structures from which the animals might leap. If a squirrel does slide down the support wire, a plastic or metal umbrella-shaped commercial or homemade baffle mounted over the feeder will deflect him.

A less complicated approach is to offer foods that squirrels simply might consider unworthy of Herculean efforts. Safflower

seed, white millet seed, and Niger thistle are favored by many desirable songbird species such as finches, cardinals, chickadees, and titmice, yet disdained by most squirrels. Of course, those who give in to the impulse to kick back and enjoy the squirrels along with our feathered wild neighbors will hear no argument from us as long as feeding is done in moderation.

Limiting Damage to Plants

Since squirrels only infrequently do significant damage to plantings, the first step is to make sure the damage is not being caused by another animal. Squirrels are only active during the day, so it should be possible to observe damage as it happens. Once a squirrel has been implicated, consider preventing access to the affected plant. Up to several fruit trees isolated from surrounding trees may be protected by wrapping a two-foot band of sheet metal around the trunk about six feet off the ground. Be careful not to leave the bands on any longer than necessary, since insect damage might occur, and the trunks of sensitive trees may get sunscald if bands are removed after a long time. Branches growing below six feet also may have to be trimmed. Squirrels show a preference for certain varieties of ornamental plants and leave others alone. Small fruit and nut trees can be protected by netting the entire tree for the short period when squirrel (or other animal) damage is most likely.

Squirrels will dig up and eat the bulbs of ornamental plants such as tulip and crocus, but they do not bother daffodils. The great variety and other desirable characteristics of daffodils as spring-flowering plants may be enough to satisfy most gardeners, but if the other bulbs are desired, several repellents on the market may deter squirrels. Bulbs can be soaked in any repellent with Thiram as the active ingredient (and labeled for use as a squirrel repellent) before planting. Other repellents registered for squirrels, with capsaicin or oil of mustard as active ingredients, can be sprayed on the plants when they first emerge in the spring. Many gardeners also report success in protecting their bulbs by laying down chicken wire over the planting bed to deter digging or using wire bulb cages.

Solving Other Issues

Squirrels who have been in attics for any period may have chewed on exposed wiring and could contribute to a potential for fires. Once they are evicted or have moved on their own, a close inspection of exposed wiring is in order. For the rare situations in which squirrels seem to be engaged in recreational gnawing on deck railings or wooden lawn furniture, we recommend trying the capsaicin-based repellents or lightly rubbing the exposed surfaces with a bar of soap. Take care to remember that capsacin can be transferred to your hands and will cause intense irritation if inadvertently rubbed in the eyes. Also use these repellents around patches over squirrel entry holes in buildings to discourage gnawing in attempts to reenter.

We have also encountered capsaicin products to coat birdseed so that it repels squirrels. This relies on the different sensory systems of birds and mammals. Birds are not irritated by capsaicin-based products as are mammals. This may be fine in principle, but the product is extremely irritating to the squirrels, and we do not recommend this when other, less harmful, and more successful strategies to keep squirrels out of bird feeders are available. Finally, we again remark on the use of sticky gels, which are marketed to deter squirrels from climbing on branches or other surfaces, as dangerous to other wildlife and inappropriate for wildlife control.

A Last Word

There are volumes written about squirrels, some focused entirely on the warfare humans conduct against them every year in neighborhoods nationwide. Readers browse the shelves in their local library for details of these complex engagements. We advocate for peace, following a simpler set of battle maneuvers to control those violations of our treaty with squirrels that must be addressed.

For those who want more action, we suggest another form of recreation. Squirrels are fascinating animals to watch, photograph, and study. They make themselves available for observation as few other animals do and have a rich and complex repertoire of behaviors to award both the novice and expert with the challenge of deciphering what they really are about. For those willing to be patient, to learn, and to watch, squirrels may just invoke more interest than enmity, as watching leads to learning, learning to understanding, and understanding to tolerance.

Resources

There are lots of books about squirrels. Kim Long's *Squirrels: A Wildlife Handbook* (Johnson Books, 1995) and Michael Steele and John Koprowski's *North American Tree Squirrels* (Smithsonian Institution Press, 2003) are welcome and highly informative additions to other resources.

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STARLINGS

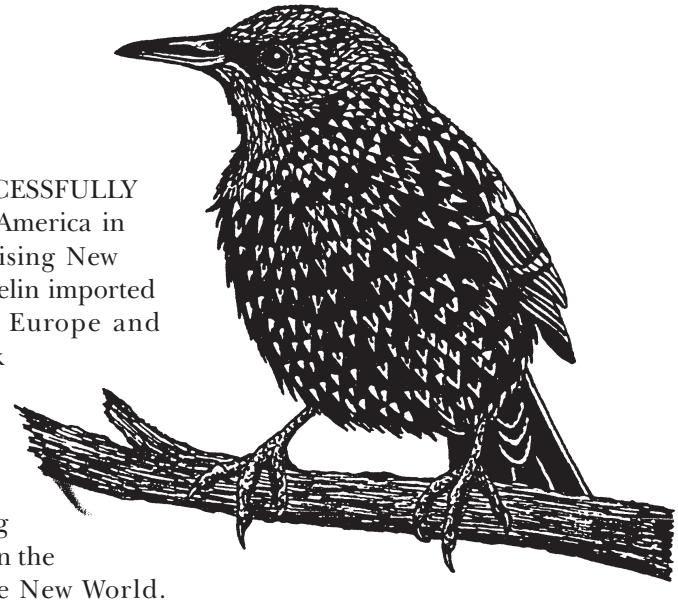


Figure 91 *Starling*

STARLINGS WERE SUCCESSFULLY introduced into North America in 1890, when an enterprising New Yorker named Eugene Schieffelin imported eighty of these birds from Europe and released them into New York City's Central Park (Figure 91). It seems Mr. Schieffelin and a small group of like-minded friends had a passionate interest in bringing all of the animals mentioned in the works of Shakespeare to the New World. Attempts with chaffinches, nightingales, song thrushes, and skylarks failed, but were compensated for and then some by the success of the starling. From the first few released, numbers have now swollen into the hundreds of millions, and the starling is said to be one of the major "pest" birds in North America. The built environments of cities and towns provides ideal habitat for these birds. These immigrants join their human counterparts from all corners of the world to create the contemporary urban community, being as Whitman put it, "blithe and strong."

- **Starlings are just one of the many species of birds commonly lumped under the term "blackbird."**
- **Starlings are cavity nesters who enjoy the warmth and security of clothes dryer vents.**
- **Starling song is quite complex, including a series of whistling notes, chatter, and a clear wolf whistle that is somewhat provocative.**

Classification and Range

The European starling (*Sternus vulgaris*) is eight to eight and one-half inches long, with a relatively short tail and a bold orange-yellow beak. Starlings are members of a very large and diverse group of passerine (song) birds found throughout the Old World. The family, which includes the vocal mimics known as myna birds, has some strikingly beautiful members. In fact, a close look at the starling in his best winter plumage reveals a quite attractive bird, once the viewer gets past learned prejudices. Juveniles are a uniform mousy brown color, but the adult plumage is a glossy green and purple with white tips on each feather. During the winter, these tips wear away, revealing the iridescent plumage below. The beak is brown in winter but turns brilliant yellow with the coming of spring. Females and males are quite similar; the only distinguishing mark is a spot at the base of the bill that is reddish in females and bluish in males.

Starlings are adept at exploiting urban and suburban environments but also do quite well in agricultural settings. Although their original habitat is little known, they are one of only a few birds that tolerate areas of high human density and disturbance. Starlings are found in otherwise barren human landscapes around industrial areas and heavily developed commercial zones. Paired birds spend most of the spring and summer nesting and raising young, and juvenile birds may collect in small flocks soon after they fledge. Winter flocks of starlings create noisy roosts sometimes numbering more than a million birds.

Starlings tolerate a wide range of food, typical of most urban generalists. They are probably more insectivorous than house sparrows and pigeons, as a close look at the bill suggests. In spring large groups of starlings often descend on lawns, much to the dismay of homeowners who fear they are doing damage. The truth is that they are probably doing the homeowner a favor by consuming insect pests. They can do damage, however, by eating fruits from gardens and farms, such as grapes, cherries, and raspberries. It is commonplace to see starlings around dumps and landfills, and many seem to specialize in picking through the open dumpsters found around apartments, grocery stores, and restaurants. Household trash placed unprotected at the curb is just a snack compared to these steady sources of food but can attract starlings who think nothing of tearing bags open with their strong, bladelike bills. Starlings will visit bird feeders, depending on their hunger and motivation, and compete with other, less aggressive birds there.

Starlings court and mate in the early spring and can be heard in song at this time. Most people do not find this somewhat strident and monotonously repetitious vocalizing to be true music, but to the student of bird song it unmistakably is. From three to eight eggs are laid in each clutch and incubated for twelve days. The young leave the nest at about three weeks of age and remain with parents for only about a week before becoming fully independent. A successful pair of adults can nest three times in a year.

Starlings are cavity nesters and will exploit any hole into a suitably sized interior cavity that permits them to bring in nesting material and set up house. Clothes dryer, range, and bathroom vents are ideal nest sites from the starlings' point of view. Even when a vent is protected by a metal flap, many starlings have learned how to hover or perch while raising flaps to get into the vent. The nesting material impairs the function of the vent and could be a fire hazard as well.

Public Health Concerns

The infectious diseases associated with starlings are shared with pigeons and house sparrows and include histoplasmosis, chlamydiosis, and salmonellosis. As with the other urban bird species, there is little direct evidence linking starlings to significant disease problems in humans.

Problems

Probably the biggest issue with starlings in urban and suburban areas is their nesting habits. This includes potential problems with house vents, as mentioned, but homeowners should also be aware that starlings build nests in any suitable house cavity. Nest material can accumulate, since the birds do not remove old material; they just add more year after year. People also complain about starlings getting into the trash, competing with desirable birds at feeders, and getting stuck in chimneys and metal flues. Large flocks, which can number tens of thousands of birds, can create considerable noise and large amounts of feces, which accumulate under roost sites.

Solutions

Tolerance

Much of the time, starlings can be tolerated by understanding that their transgressions are minor or temporary and that permanent solutions to real problems can be carried out when the time is right. Starlings should be tolerated, for instance, in the spring, when visiting flocks work over lawns, probing for grubs and cleaning up insects among the new growth. They undoubtedly perform a service to the homeowner in this manner. Nesting starlings should be tolerated whenever possible until the young have fledged. The nest site can then be cleaned and sealed to prevent reuse.

Exclusion

Proactive exclusion of starlings from known or potential nesting sites is the approach of choice. Starlings discovered early in the nesting process, before eggs are laid, can be evicted and the openings they were using sealed with hardware cloth, metal flashing, or commercial vent cover. Lighter material, such as plastic netting or window screening, rarely keeps determined starlings out. With their strong bills, they simply tear lighter material open. Nests with young can often be located by the sound of begging nestlings or the characteristic fan-shaped trail of smeared droppings that spot a wall below a corner joint or other entrance to a cavity. Vents can be screened with hardware cloth or commercial vent covers and entrances to other cavity nest sites with sturdy material such as hardware cloth or metal flashing, once the young leave the nest.

Nest Removal and Relocation

Where nestlings are present and must be removed before they can fly, we advocate the approach developed by Brad Gates. Starlings are one of only a very few bird species in North America not protected by federal law, so handling and relocating young is permitted. *This is not the case for the vast majority of other birds!* AAA relocates the nest with the young so that parents can continue to feed and raise them. Take young and nesting material out of the vent or duct and put them in a suitable container that serves as a substitute nest. A large plastic soda bottle with drainage holes added to the bottom can be an alternative nest. Cut a flap for an entrance hole about two-thirds of the way up its side and raise the flap to form a weather shield above the entrance. The key to success is to locate this nest as close as possible to the old nest entrance and to have vocal young in it so the parent starlings respond to normal cues that prompt them to attend to nestlings.

Scare Devices

Both visual and auditory frightening tactics offer viable approaches to solving problems with starlings. A variety of noise-making devices, including recorded distress calls, are available to frighten these and other birds. Visual stimuli such as mirrors, pie tins, revolving lights, colored flags, scare tapes, and balloons can also be effective in frightening starlings away.

Repellents

A variety of repellents are registered for use on starlings. The majority of problems homeowners encounter, however, do not lend themselves to the use of repellents as much as they do to other techniques.

Habitat Modification

Food and nesting sites can be limited in places where starlings are a problem and, ultimately, are essential approaches to influence the numbers of these birds. Places where starlings are roosting and found to be intolerable can also be addressed by methods recommended for crows that modify the site to make it less accessible and/or acceptable to the birds. Refuse can be an important food source for a local population of starlings, and both homeowners and businesses should share in the obligation to control starling access to dumpsters and household trash. Making sure that dumpsters are covered and not routinely overfilled is a great step in limiting access to food. Placing household trash in covered containers rather than in plastic bags along the roadway goes a long way toward limiting starling access.

Malls, small shopping centers, warehouses, and even office buildings provide sometimes abundant nesting opportunities. Systematic identification of used or potential nest sites and proactive exclusion is a key to reducing starling presence. Sites used in the current nesting season are usually easy to find, even after young have left, because of the telltale fan of white droppings. These can be marked and slated for later exclusion work when young have left.

A Last Word

In 1910, long after the birds had already left the barn, Congress passed a law making it illegal to import starlings into the United States. Such a law would still have served a purpose if it had set a precedent to influence later introductions, but it seems not to have. Nonnative plants and animals can find themselves unopposed when occupying certain ecological niches and can be well equipped to compete with native species and prosper. The result can be ecological and economic disruptions from creatures as varied as zebra mussels to snakehead fish. Real or imagined, the consequences of such introductions are often wide-scale attempts to eliminate a species, as we have seen in the trapping of nutria in Maryland or the killing of mute swans justified by the claim that they are destroying aquatic plant communities. If they are destroying plant communities, what are we human beings doing to them? After all, we're not exactly a native species here ourselves.

Resources

Helen Ross Russell's *City Critters* (The American Nature Study Society, 1975) includes a fascinating and informative chapter on starlings.

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TURTLES

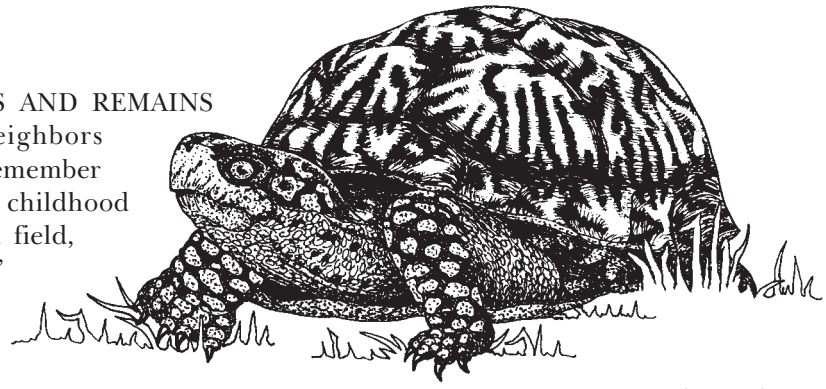


Figure 92 *Eastern box turtle*

THOUGH IT WAS AND REMAINS one of the wild neighbors many of us can remember first encountering in our childhood adventures in forest and field, the "common box turtle" isn't so common anymore. This chapter is, frankly, a plea to leave box turtles in the wild so our grandchildren and great-grandchildren can thrill to their discovery there.

On the surface box turtles may not seem to have much in common with right whales, grizzly bears, and elephants. They occupy markedly different habitats, eat vastly different foods, and engage in social behaviors that range from going it alone to staying with their families their entire lives. What they do share, however, is a strategy for success that relies on a life long enough to ensure that at least one or two of their offspring survives to replace them in the population. Box turtles are to the eastern and central United States what grizzlies are to the west, an indicator of how well we are doing in protecting habitats and connecting them together to ensure the species' survival. Unfortunately, every long-term study indicates that box turtle populations are declining. Although the box turtle is

- **There are four species and eleven subspecies of box turtles, occupying a wide range of habitats from eastern forests and meadows to tropical Mexico.**
- **The leg muscles of box turtles are extremely strong, a necessary adaptation given the weight and inflexibility of their shell.**
- **Eastern box turtles generally do not dig down very far below the surface of the soil to wait out the long winter months—the top of their carapace may even be above the soil. In contrast, ornate box turtles dig down well below the surface.**

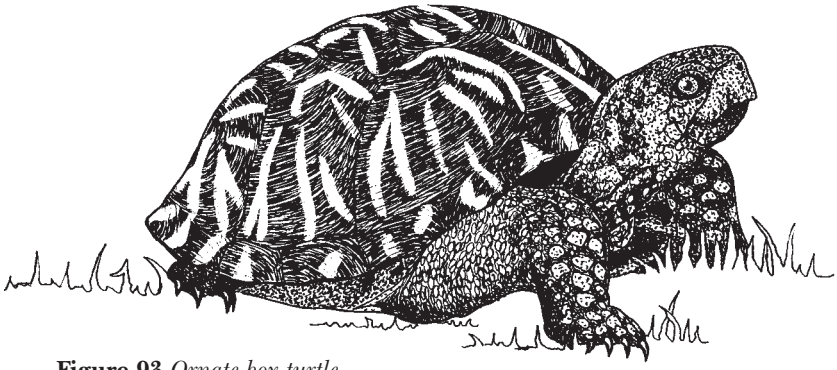


Figure 93 *Ornate box turtle*

not listed as threatened or endangered, it is increasingly included on state lists of sensitive species. We are not doing very well in securing the future of this reptile, perhaps because there is likely to be no wild animal more threatened by the human-dominated landscape of the eastern United States than the box turtle.

Classification and Range

Box turtles belong to the genus *Terrapene*, with the eastern (*T. Carolina carolina*) and the ornate (*T. ornata ornata*) the two species most often encountered(Figures 92, 93). The eastern box turtle ranges from Massachusetts into parts of the Midwest, with very similar variants found to the south, into Florida and through parts of Texas and Oklahoma. The ornate box turtle is found through the Plains states and Texas and into parts of the Southwest.

Habits

An animal very like today's turtles has existed on earth for two hundred million years. What sets all turtles apart from other reptiles and, indeed, the rest of the animal kingdom is their shell. The hip bones of turtles actually lie within their ribcage, which is fused to the top of the shell. The shell is the turtle's primary means of protection from predators and other perils, and each individual invests many years in its growth. As a result box turtles may not reach breeding age for eight or more years after hatching. They may live in the wild for fifty years, although individuals decades older are occasionally reported.

Box turtles eat a variety of green plants and fruits, but they are also fond of slugs, worms, insects, and the occasional small mammal or bird. Females may lay six or so eggs each year, with the temperature of the surrounding soil determining whether the young are males or females. Once they lay their eggs in a flask-shaped nest of their own making, females leave the nest and do not return. The hatchlings are on their own as soon as they emerge. Young box turtles cannot close their shells fully, which at any rate are relatively soft and offer little protection for their first few years. As a result juvenile box turtles hide for their first few years in dense thickets of vegetation and are almost never seen.

Problems

Most box turtles do not survive long enough to breed. Foxes, skunks, raccoons, opossums, crows, turkeys, domestic dogs and cats, and other animals that thrive in close association with human beings won't hesitate to eat turtle eggs as well as young turtles, whose shells are not yet hard enough to provide much protection. Those turtles who do survive must move within their home ranges to find food, mates, moist spots during summer dry spells, and safe dormancy sites for the winter. Females often must travel outside their home ranges to find loose soil in sunny areas to lay their eggs. With forested habitats increasingly succumbing to suburban sprawl and the roads, cars, lawn mowers and weed whackers that accompany development, turtles are killed outright or separated into ever smaller habitats where too few survive to sustain their populations.

Combined with the tendency of many people to pick up a box turtle they find crossing the road and take him home as a pet for their children—the fate of thousands every year—it is no surprise that the wild population of box turtles is plummeting. Indeed, box

turtle populations in the fragmented habitats typical of the eastern United States are so sensitive to the loss of adults that, according to modeling studies, the loss of just three from a population of fifty males and fifty females could doom that population to a slow but irreversible decline to extinction. Every one of the fifty or so years that a wild female box turtle might live is crucial in ensuring that, of the five or six eggs she may lay a year, at least one of her young survives to adulthood to replace her in the population.



THE HSUS

Figure 94 *The culprit was caught in the act, or the gardener here might never have figured out that a box turtle was taking the low-hanging tomatoes. The solution in this case was to do nothing, except wish the turtle well. Like many of our wild neighbors, the turtle was welcome any time he wanted to come around.*

One wonders why the remedy to the box turtle's decline might not simply be to add turtles from habitats where they are relatively abundant to areas where they are declining. Though that may seem like a solution, box turtles are nature's homebodies. Relocating wildlife as a solution to conflicts is often neither humane nor effective, and this may be especially true for box turtles. They may spend their entire lives in an area no bigger than a couple of acres, where they know every nook and cranny—where the best spots are for finding food or for water on hot summer days or for safe digs to wait out the long winter months (Figure 94). If taken from their homes and released somewhere else, they use their amazing ability to orient by the sun and the earth's magnetic field to head home—or to wander in search of it—thereby facing all the hazards that such journeys hold. (The genetic and disease implications of moving box turtles around are completely unknown.)

Solutions

The only workable solution to ensure that these reptiles remain a part of our fields and woodlands is to protect their habitats, to eliminate as much as possible their death under our tires, and to resist the urge to convert any turtles we encounter from wildlife into pets.

Property owners whose land is adjacent to wooded box turtle habitat should search their lawns before mowing, particularly that portion of their lawn at the woods' edge, and try to mow during the heat of the day, when turtles are less likely to be out in the open. Those who encounter a turtle in the road should move her well out of harm's way in the direction she was headed. And all who care about wildlife should urge their state departments of transportation to include in road design and improvement projects pathways for wildlife to cross roads safely, along with fencing that funnels wildlife to those pathways.

A Last Word

Archie Carr, the grand old man of sea turtle research, described the box turtle as "an altogether appealing animal." There may be no more apt description of this shy and gentle creature who asks no more of our species than protection of its habitat and, once in a while, a little help across a busy road.

Resources

C. Kenneth Dodd's *North American Box Turtles: A Natural History* (University of Oklahoma Press, 2001) is a very readable natural history of these fascinating animals. A number of researchers and turtle specialists have agreed to meet periodically to address concerns about

box turtles, and The HSUS has published the summary of the first workshop this group held, in 2004. Edited by Chris Swarth and Susan Hagood, *Summary of the Eastern Box Turtle Regional Conservation Workshop* is available by contacting The HSUS at 202-452-1100.

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VOLES

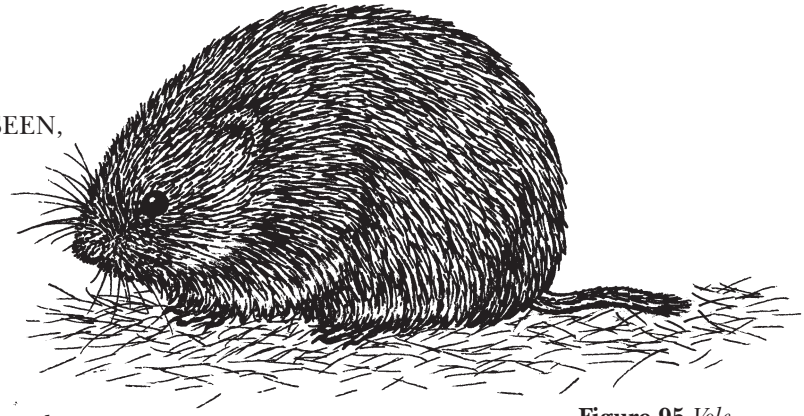


Figure 95 *Vole*

ALTHOUGH RARELY SEEN, voles are surprisingly common in many cities (Figure 95). In the heart of Washington, D.C., even the President's garden has been occupied by voles. The White House maintains almost seventy thousand square feet of the popular ground cover *Euyonomus*, a plant susceptible to vole damage as these small creatures gnaw and girdle plant stems, causing their dieback. The beds began to look terrible in the mid-1980s, and meetings were convened, options discussed, and plans drawn. Somehow, before action of any sort could be agreed on and taken, the vole population seemed to crash, with damage declining to a point where it could be accepted. Like those of many small rodents, vole populations can swell seemingly overnight. Even then, voles are far more likely to be a serious concern to commercial agriculture than to homeowners, and most of the strategies that have been developed to deal with them reflect that.

- **Voles are not mice, nor even as closely related to them as they are to muskrats.**
- **If voles are not mice, and mice are not moles, and voles are called meadow mice—no wonder many people are confused.**
- **Keep the cat indoors. Unless kitty brings one in, the chances are you will never even see a vole.**

Classification and Range

Voles, also known as meadow mice, are not mice but members of a large and complex group of rodents called arvicolids. There are approximately twenty species in the genus *Microtus* alone, depending on the latest consensus of the experts, but only some six or seven are generally considered to cause significant problems for human beings. All are mouse-size (six- to eight-inch) animals that weigh about four to five ounces and have stocky, compact bodies. Their ears and eyes are small relative to other common mouselike animals. Their most distinguishing physical feature is a relatively short tail, less than three inches long. Both house (*Mus musculus*) and deer (*Peromyscus spp*.) mice, with which voles are often confused, have tails that are at least as long as their bodies.

The voles who most often cause damage are the prairie vole (*M. ochrogaster*), meadow vole (*M. pennsylvanicus*), pine or woodland vole (*M. pinetorum*), montane or mountain vole (*M. montanus*), Oregon vole (*M. oregoni*), and California vole (*M. californicus*). Meadow and prairie voles cause surface damage, while woodland voles cause damage beneath the soil. The pine and Oregon voles spend almost all their time underground, thus making control methods different. Because there is extensive range overlap of some species, precise species identification is important when dealing with these animals.

Habits

With so many different types of voles throughout North America, it is not surprising that they live in a wide variety of habitats. Even in one habitat, different species of voles may overlap, avoiding direct competition by exploiting specialized niches. Several species are considered to be agricultural pests, having moved easily from traditional habitats into commercial fruit orchards, crop fields, and pastures. The affinity of some voles for forest edges with moist loose soil high in organic matter easily brings them into residential areas and occasional conflict with homeowners.

Voles are primarily herbivores (plant eaters) and are not to be confused with moles, who almost exclusively eat insects. Voles forage on grasses, flowers, seeds, vegetables, fruits, bulbs, and roots, although they will occasionally consume animal matter such as insects and snails. In winter voles make tunnels beneath the snow and gnaw the bark from trees and shrubs under its protection. They also horde food in underground caches holding as much as a gallon of stored nuts and berries. Historically, Native Americans often raided these caches to supplement their own winter diet.

Voles usually only live about one year, but they make up for their short lives by prolific breeding. In the wild there may be four or five litters each summer, and even more in warm climates, where they can breed year-round. Depending on the species and geographic region, the average litter size varies from two to five young. Within three weeks of birth, females may breed again, with gestation only twenty to twenty-three days. With this kind of reproductive potential, populations can expand rapidly. Populations in orchards can attain high concentrations, because landscaping practices such as mowing (which leaves a protective layer of thatch) and fertilization (which results in dense ground cover) inadvertently create optimal vole habitat. Vole populations are cyclical. During spans of about three to six years, vole populations experience dramatic fluctuations. Years in which populations grow rapidly are sometimes called "mouse years."

While all species of voles do some burrowing, certain specialists, such as the pine and Oregon voles, are almost entirely subterranean. Others, including the meadow vole, construct obvious runways on the surface of the ground, clipping and mowing in their own fashion to maintain a network of trails partly covered by overlapping vegetation. These are easily seen on close examination and may be especially obvious after snow melts and the trampled runway grass stands

out. Nests are usually well built and provide refuge from weather extremes as well as places to rest and raise young. Voles may spend the bulk of their day in these, coming out to feed for short periods during both day and night.

Public Health Concerns

Voles are not considered to be a significant source of any infectious disease that can be transmitted to people. They are known, however, to host such communicable diseases as tularemia and bubonic plague.

Problems

The worst damage done by voles is to agricultural crops; orchards are most likely to suffer damage. They may also damage fruit trees in yards and parks. Voles debark fruit trees under the cover of snow and can kill the trees by complete girdling. Voles also feed on the roots of fruit trees, primarily during the winter. These may be more attractive then because apple tree roots, for example, contain more sugar and starch during the winter than in any other season. In winter voles seem to spend more time close to their nests, and, because these are frequently located near tree trunks, roots may be eaten more frequently. Typical vole damage occurs within the first decade after planting, because, as trees mature, they are better able to survive and fend off damage.

Voles will use mole tunnels to reach plant roots and bulbs and, in fact, voles often cause damage that is blamed on moles. Shrubs such as blackberries and raspberries and occasional garden vegetables may be damaged, as may plants in growing frames and greenhouses and certain shrubs and bulbs in the ornamental garden.

Solutions

Tolerance

Because of their prolific breeding potential and high susceptibility to predation, vole populations may wax and wane dramatically. Such fluctuations mean that sometimes a "problem" with voles will resolve itself without any active intervention at all. Correctly identifying voles as the cause of the damage, evaluating its extent, and determining acceptable limits of damage are critical to making plans for intervention with voles. Sometimes the best solution to vole problems is patience and the understanding that what happens today may not happen tomorrow.

Habitat Modification

The control of vole damage should focus on habitat management to make conditions less favorable for these animals. Agricultural practices undoubtedly support large vole populations, especially where crops they prefer are planted in large blocks. Support for high-density populations may be reduced through soil cultivation practices that inhibit the development of burrow systems and reduce ground cover. Frequent, close mowing in orchards may reduce both cover and "carrying capacity" (the number of individuals in a population the environment will support) for these animals and can be an important part of an integrated approach to population management.

Clearing vegetative debris from grassy areas next to gardens and crops is often a useful prevention measure, as might be clearing vegetation from a three-foot radius around the base of a tree or shrub that has been attacked. However, because woodland voles remain below ground, this tactic may not affect their activities. In northern climates snow may provide cover for voles at the time of year when plant damage is most likely. Clearing snow away from the base of trees may be helpful when just a few trees need to be protected. Deep beds of mulch also encourage voles by allowing them to move through tunnels between the mulch and the

ground. Reducing the layer of mulch to one to two inches may discourage voles.

Tulips and hostas are favorite foods of voles and may occasionally sustain much damage. Homeowners whose plants are repeatedly assaulted by voles should consider substitute plants, such as daffodil (*Narcissus spp*.), crown imperial (*Fritterlaria spp*.), and grape hyacinth (*Muscari spp*.), which voles find less palatable. Another approach is to plant voles' ornamental favorites in large pots rather than directly in the garden. To prevent voles from gnawing on tree bark, try wrapping plastic, metal, or cloth barriers around the trunks of individual trees. Tar paper may also be used for this purpose.

Repellents

Voles' damage to ornamental flower beds typically comes from their consuming bulbs of plants such as lily and tulip. Soaking bulbs in one of the capsaicin repellents registered for voles before planting could provide some deterrence in areas where this is a serious problem.

Predators

Voles are important in the diet of many predators, including snakes, hawks, owls, foxes, coyotes, weasels, mink, and badgers. Predators do not eliminate prey species entirely. Natural predation, however, can help keep numbers down to a point where other management strategies become far more effective. Raptors can be particularly helpful, and erecting nest boxes for species such as barn owls and kestrels can encourage their presence. It is also possible to attract hawks and owls by erecting T-shaped wood or metal perches these predators can use as observation posts to scan fields for voles and other small mammals.

A Last Word

Eradicating any species from the landscape is rarely possible, and, in the few cases where it has been achieved, it has been to remove small populations of nonnative species. There is a debate concerning the wisdom of such efforts. For a native species, that debate has swung from whole-hearted approval of the destruction of entire groups, such as the predator eradication programs our government sponsored not too many years ago, to embracing the ecological appropriateness of complete biological communities. The lowly voles have not quite made it to the standard of acceptance and appreciation that the grizzly and timber wolf have, but they are equally deserving of our understanding and respect. Their day, one hopes, is coming, too.

Resources

Although there are many studies of voles with published findings, we could not locate any general natural histories of these animals that we could recommend for further reading. Along with better recognition then, we can hope that better understanding will come someday soon as well.

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WATERFOWL

(DOMESTIC DUCKS, GEESE, AND SWANS)

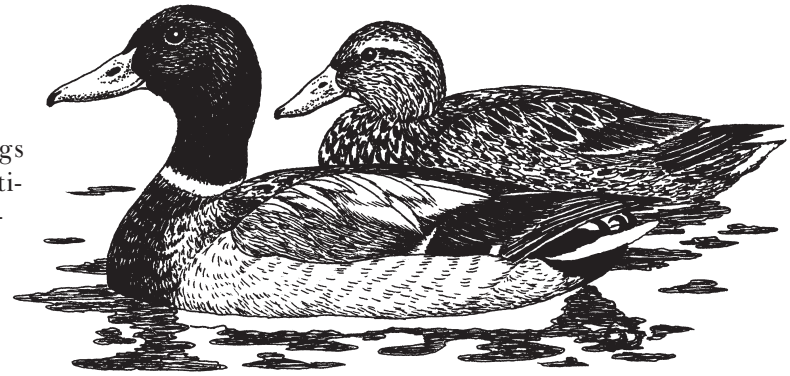


Figure 96 *Mallards*

WHEN THE VERY first human beings arrived on this continent, they saw waterfowl living by an already ancient seasonal pattern. Spring sent them north to breeding grounds, and the return voyage in fall introduced new members of the flock to migratory pathways. Even when the first Europeans arrived millennia later, the flocks were still abundant beyond belief. Soon, however, these newcomers presided over the decimation of migratory birds through overhunting and destruction of land that had supported an enormous variety of species. At the turn of the twentieth century, it looked as if migrant waterfowl might no longer occupy the sky. Strong laws protecting them and late efforts to conserve diminishing wetlands helped bring some species back from the brink, but the final outcome for many wild migrating duck populations remains in doubt.

Meanwhile, "resident" ducks, geese, and swans living year-round in cities and suburbs have become more common in the last few decades. It is not clear whether some city ducks were originally part of wild migrating flocks who decided to settle down or if they

- **Mute swans, like giraffes, are not truly silent, just unusually reserved when it comes to vocal behavior.**
- **The sight of ducks' upended tailfeathers on local ponds is not social commentary, but rather the consequence of ducks' foraging on the pond's shallow bottom (no pun intended).**
- **Most of our domestic ducks descend from the mallard, except the Muscovy, which was originally domesticated in South America.**

ended up as residents because people put them there. Abandoned domestic and captive-bred birds and their descendants, dumped by owners who did not want to care for them or escapees from private shooting preserves, form a large part of these urban populations. These birds never had the chance to learn migration behavior and pathways from wild parents or even had the ability or inclination to fly in some cases. They are stuck with us, whether they wish it or not.

Classification and Range

The mallard (*Anas platyrhynchos*), by far the most common North American duck, is present year-round in many urban ponds (Figure 96). The brown female is drab in comparison to the typical male, who has a green head, white neckband, and rusty chest when wearing his "nuptial plumage."

The term mallard covers a number of regional subspecies or "races." The American black duck (*A. rubripes*), the Florida and mottled ducks (*A. fulvigula spp.*), the Mexican duck (*A. platyrhynchos diazi*), and the Hawai'ian duck (*A. wyvilliana*) are all more or less related to mallards and can interbreed with them, creating hybrid offspring. The Mexican duck has become so mixed with mallards that many authorities no longer consider it a distinctive subspecies. The American black duck, Florida duck, and mottled duck may be similarly at risk of being hybridized out of existence.

Domestic varieties of ducks and geese live free in many towns and cities. The Pekin are large white ducks with orange feet and black bills. Rouens look like a very large version of their mallard ancestors. Male Muscovy ducks (*Cairina moschata*) have a pronounced knob at the end of the bill that is a characteristic identifier. Embdens are large white geese with bright orange bills, the classic image of a barnyard goose. The white variety of Chinese goose looks similar but has a smaller body and a knob on the bill. The Toulouse goose is large and gray with a distinctive dewlap (loose skin hanging under the neck). The mute swan (*Cygnus olor*) is a large (up to five feet long) white bird with a strongly contrasting black knob at the base of a deep orange bill (Figure 97). Increasingly mute swans live in free-ranging breeding populations in natural coastal and freshwater habitat. These nonmigratory swans are now resident along the Atlantic coast from New Hampshire to Florida, around the Great Lakes and southern Ontario, and along the Pacific coast from British Columbia to Washington State.

Hybridization between and among wild and domestic waterfowl confuses identification of urban ducks and geese. Many different wild ducks and geese use urban and suburban ponds as stopovers when migrating as well. These factors create a complex mix of wild, domestic, and hybrid ducks and geese at urban and suburban lakes and ponds throughout North America.

Habits

While wild waterfowl prefer to breed in wetlands, the urbanites we discuss here will live near whatever water they find, and, famously in the case of the ducks, sometimes near none at all. Those descendants of domesticated birds, being flightless or poor fliers, cannot readily relocate to new or better habitat or make seasonal habitat changes, and the artificial ponds and lakes of city and suburb are especially attractive to them.

The mallards and domestic varieties of ducks commonly seen in city parks eat a wide variety of foods, including both terrestrial and aquatic plants, young tender grass, grass seeds, berries, and even acorns and beechnuts. Young ducks leap up and race across the water to catch tiny insects, which are ducklings' main fare in their first weeks of life. Geese are primarily grazers and are always vegetarian, favoring tender grass shoots as well as some aquatic plants. Swans satisfy themselves with aquatic fare, eating primarily submerged vegetation, along with aquatic insects, mollusks, tadpoles, and sometimes larger amphibians. Any of these waterfowl are typically willing to accept human handouts.

Mallards use elaborate courtship dis-

plays, and drakes (males) grow distinctive bright-colored plumage to attract and bond with a new mate each spring. Drakes do not help build the nest or care for the young. After mating they often defend the nesting territory only until the hen begins to incubate eggs before leaving permanently. On average hens lay nine to ten eggs and incubate them for twenty-eight days. Urban mallards are renowned for their tendency to build nests in strange places, including flower boxes, building alcoves, and flower beds, preferring nest sites in cover such as tall plants or bushes. Muscovy ducks originally nested in hollow trees and similar cavities, but their domestic descendents will nest in dense waterside vegetation when cavities are not available, incubating for an average of thirty-five days.

Descendants of domestic geese are often not choosy about their nest sites; many seem willing to nest just about anywhere. Some prefer open areas near water where they can see anything coming; others prefer some vegetative cover for nesting but also stay within walking distance of water. Ganders (males) are more attentive parents than are duck drakes, staying with the family and defending the nest site and goslings, sometimes quite vigorously. On average, geese incubate five eggs for twenty-eight to thirty-five days.

Male mute swans behave more like geese than ducks and stay close by nests and mates, defending their family assertively after the young cygnets are hatched. Mute swans lay four or five eggs, on average, and incubate a relatively lengthy thirty-seven days.

Public Health Concerns

None of the species addressed here is implicated in any serious public health threat to humans, although their droppings are increasingly cited as a water-quality concern in municipal lakes and ponds. Botulism outbreaks in waterfowl involve a strain that is not transmitted to humans.

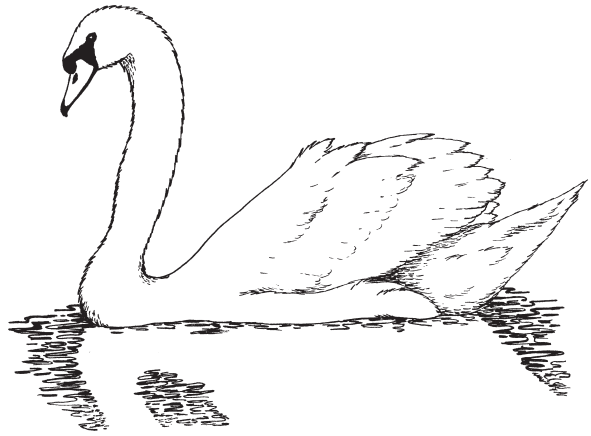


Figure 97 *Mute swan*

Problems

The primary conflict between waterfowl and humans is over lawns, decks, docks, and sidewalks, where large aggregations of birds can create a problem with their droppings. This is an aesthetic, convenience, and (some say) sanitary issue. Grazing by domestic geese seldom causes serious damage to lawns because they do not dig turf and are rarely present in large enough numbers to denude grass areas. Ducks eat grass, but their varied diet means they are not likely to have much impact on lawns. Most often, it is the fecal deposits and the numbers of birds that produce conflict. People can regard this as a nuisance on lawns they use frequently. Flocks of birds can act as decoys to attract other waterfowl, such as Canada geese, to some sites.

Occasional problems occur with geese guarding their nests. Protective responses are strong in these birds, and they are known to confront or even physically challenge people who come too close.

Ducks, and very occasionally geese, sometimes decide the most artificial ponds of all—swimming pools—are excellent places to hatch and raise young. This can lead to concerns for the welfare of the young birds if they have trouble getting out of the pool. Regular use by waterfowl may also raise sanitary concerns for human pool users. The mallard habit of walking very young ducklings from nests to water sometimes leads to ducklings slipping into storm drains and crossing traffic

behind their mothers. (The children's book *Make Way for Ducklings* has immortalized this behavior of mallards in Boston's Public Garden for generations of young readers.)

Some state wildlife agencies have declared mute swans a danger to submerged aquatic vegetation, their primary diet. The importance of aquatic vegetation in maintaining and enhancing water quality is not disputed. However, it is reasonable to ask, where mute swans are blamed for problems, that their impact on habitat be compared objectively to damage being done to both vegetation and water quality by people and their activities, especially by agricultural and landscaping practices.

Solutions

Tolerance

Tolerance is the norm between people and the waterfowl they encounter in urban and suburban areas. Indeed, people seek out places where they can enjoy these birds, purposefully strolling around the pond in a park to see the ducks and geese. These birds cause so little conflict and so much pleasure that it is only in rare instances that steps to resolve conflicts are needed.

Limiting Feeding

Human "generosity" can attract and retain waterfowl and allow flocks to grow to greater numbers than under natural conditions. While the occasional handout is of little consequence, sustained feeding is not recommended for the birds' welfare. Human food is not a healthy diet for birds, and even domestic waterfowl rarely need human-provided food to survive. Unless abandoned in very unsuitable or overcrowded habitat, these birds are successful at feeding themselves.

For flightless domestic birds in unsuitable or overcrowded habitat, feeding nutritionally appropriate food may be a short-term measure until the birds can be relocated. If sustained feeding has allowed flocks to grow beyond the numbers the habitat can support, feeding in regulated quantities may taper off until the birds are not dependent on human-provided food. Flighted waterfowl at urban ponds do not need human-provided food; they will simply move to better forage if necessary.

Abandonment

Domestic varieties of ducks and geese may get by at many urban ponds, but these places are not best for them. Flightless domestics are at greater risk from wild predators, vehicles, and even dogs and cats than are flighted birds. If the numbers of birds build up, people may become intolerant of the droppings and the birds may be removed and killed. Domestic animals, even those who resemble wild species, cannot simply be "set free" and enjoy a good life. This is never kind to the animal and is frequently illegal. Many baby ducks and geese given as gifts at Easter or in promotions or as prizes have owners who, unprepared for and frequently uninterested in giving them appropriate lifelong care, tire of them and drop them off at local lakes or ponds. Animal lovers and state and local authorities must work together to educate the

Coots

Most people think of "coots" as grumpy old men, but another sort of coot is a small and retiring bird related to rails and cranes. Like ducks and other water birds, coots inhabit ponds around homes and recreational areas and come ashore to forage. Coots can be more destructive than ducks when grazing on lawns because they also forage for insects and worms, damaging turf with the strong claws of their hind feet. In California, where these birds have long been regarded as agricultural pests, many are shot annually because people are unwilling to work toward nonlethal solutions.

public that owners of all domestic species are responsible for their animals' care and that no domestic animal, bird or mammal, should be dumped.

Exclusion

The exclusion techniques described in chapter 15 on Canada geese generally apply as well for the species considered here.

Harassment

Ducks and domestic waterfowl can be scared or humanely harassed away from small areas where they are causing problems. However, since many of these birds cannot fly or fly only poorly, they cannot be harassed entirely out of a local habitat. Harassment may teach them to avoid specific trouble spots such as boat docks, beaches, picnic areas, or playing fields within a larger area if the birds have free use of other parts sufficient to meet their needs.

Harassment works best when used early, before the birds have settled in; consistently, so birds cannot simply "wait it out"; and when attractants such as people feeding are not counteracting the harassment's effect. Birds get used to almost all harassment techniques in time. Multiple harassment techniques combined with other strategies will be more effective than will one technique alone or a scattershot series of techniques. Simple scare devices such as scarecrows and other effigies designed to move (plastic flags, eyespot balloons, and Mylar® or flash tape) and other devices designed to scare birds can work in these limited circumstances.

Repellents

Methyl anthranilate and anthraquinone can be sprayed on grass to make it unpalatable. This may be of some help, especially with geese, in directing them away from lawn areas many people use, but untreated grass must be available to flightless geese. Sprayed-on repellents typically will not deter birds from walking or nesting in the treated areas. The useful duration of these applications varies greatly, especially in wet conditions and on grass that is mowed frequently. Methyl anthranilate can also be dispersed into the air from special equipment as a fog that irritates all birds so they leave the area.

Limiting Flock Growth

Where conflict is developing or anticipated because of growing numbers of ducks and domestic geese, it may be prudent to curtail reproduction by egg addling or removal. This requires a long-term commitment to have any significant impact on flock size because it only reduces potential young added to the flock, not adults. A permit from the U.S. Fish and Wildlife Service (USFWS) must be obtained to addle eggs of any wild duck or goose, and we recommend contacting state wildlife officials in any situation where addling any waterfowl is being considered. Since great care must be taken to identify bird species and ensure only eggs of the appropriate species are addled, it is best to work with state agencies.

Returning Domestic Waterfowl to Human Care

When domestic ducks or geese suddenly appear at a pond, they should be treated as any other abandoned domestic animal and returned to human care as quickly as possible. Domestic waterfowl can form feral colonies, especially where they are being fed, but life is hard for these birds. Unlike their wild cousins, who are shaped by nature and taught by wild parents to deal with natural dangers, these products of generations of human breeding are ill-equipped for the wild.

In some places, however, domestic waterfowl have been surviving for some time and causing little conflict with people. In such a stable situation, it may not be necessary or beneficial to the birds to remove them, especially since potential new homes may be limited. If they remain, a few steps are prudent. Public education and extreme vigilance must be undertaken to prevent additional abandonments, because people are most likely to dump birds where they see similar birds. Limiting flock growth may be considered, so the numbers of birds do not grow to exceed local tolerance.

Local animal-control authorities should be able to help any abandoned domestic waterfowl, either directly or by referring to appropriate resources. Volunteer organizations dedicated to helping farm animals may be able to identify appropriate places for them. Wildlife rehabilitators are another excellent resource; they field many calls each spring about abandoned domestic baby ducks and geese, since many people seeing these birds at local ponds incorrectly assume they are wild orphans. Rehabilitators often also can help abandoned domestics or be able to direct people to appropriate resources.

Rescuing Young from Swimming Pools, Storm Drains, and Traffic

If a duck or goose adopts a "concrete pond" to raise a family, ducklings or goslings may be stuck in the pool if the water level is too low for them to jump up over the edge. The simplest solution is to add water. If this is not feasible, you can fish the ducklings or goslings out with a net. Another alternative is to create a ramp for them to walk up and out of the pool. It should be at no greater than a 45-degree angle and have a rough surface for traction; a wet towel is good for this. One way to create a ramp is to float something, such as an inflatable raft or the lid from a Styrofoam cooler, next to the pool edge. Drape a wet towel over the raft or lid and up over the edge of the pool.

Birds walking their young from nests to water in urban and suburban areas will often lead them across streets and parking lots where the ducklings or goslings occasionally slip into storm drains or get hit by vehicles. If people see a waterfowl family walking through an urban area, a human escort should be dispatched to allow the birds an obstacle-free path to their new home. Local animal-control authorities, law enforcement personnel, or wildlife rehabilitators can assist in these situations. Like Michael, the Good Samaritan in *Make Way for Ducklings*, many real police officers step in every year to help urban duck and goose families get to their destination safely.

A Last Word

To most people resident ducks and geese at local lakes and ponds are members of a natural community, albeit one that has been significantly shaped by people. The lines people draw around closely related birds, such as wild and domestic members of the mallard complex, are artificial constructs people make for their own convenience. People do not and cannot control complex living communities to such a degree that they can force their members to conform to arbitrary lines. When ducks and geese select mates who cross the arbitrary lines between wild and domestic species, perhaps we human beings need to rethink the reasons why we drew the lines in the first place. Attempts to put the genie back in the bottle by removing and killing some birds because other birds find them perfectly acceptable mates are misguided. Life is messy this way, but we cannot clean it up by killing animals who do not fit neatly into our man-made categories.

Resources

A good bird guide can be an invaluable aid in sorting out who is living in your local pond. Among the many available is *The Field Guide to the Birds of North America*, fifth edition (National Geographic, 2006).

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WOODCHUCKS

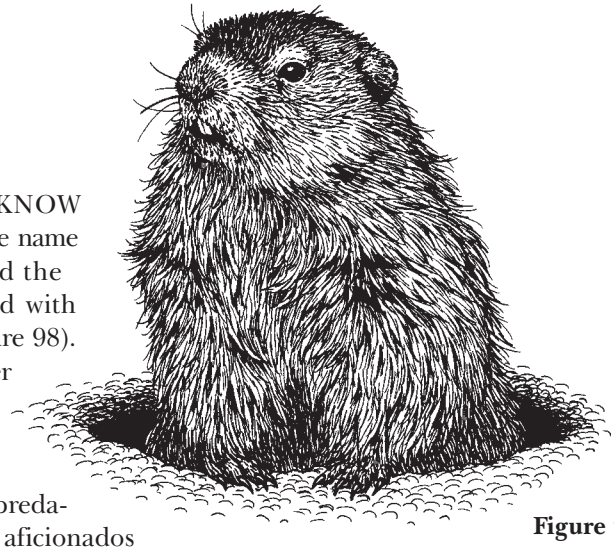


Figure 98 *Woodchuck*

MANY PEOPLE KNOW woodchucks by the name "groundhog," and the two terms seem to be used with about equal frequency (Figure 98). "Whistle pig" is also a proper appellation, but less used. It is, however, a better descriptor for this species, which whistles shrilly at a predator's approach. Woodchuck aficionados make the news once a year on February 2, nationally recognized as Groundhog Day. On this date, Phil, a chosen representative of the species and resident of the small Pennsylvania town of Punxsutawney, traditionally captures the nation's attention by prognosticating on the duration of winter. If Phil sees his (or her) shadow, the nation will have six more weeks of winter; if not, spring is on its way. Modern science cannot explain why this event predicts climate, reminding all that there are still many mysteries on the planet to be solved.

As with many other species of wild animals that occasionally trouble people, woodchucks have greatly benefited from human alteration of the landscape. The conversion of wooded habitat to cropland started landscape improvements for the species, but

- **The name "woodchuck" comes from the Cree Indian word "wuchak" (which is not to be confused with the more contemporary "Whazup?").**
- **During hibernation, a woodchuck's body temperature decreases dramatically as she takes as little as one breath every six minutes.**
- **Recent behavioral studies suggest that these animals have no interest in any form of manual labor, much less in chucking wood.**

where farmlands are converted to subdivisions, woodchucks often make the transition from rural to suburban as well.

Classification and Range

The woodchuck (*Marmota monax*) is a large, bulky rodent, weighing five to ten pounds and measuring sixteen to twenty inches in length, with a tail four to eight inches long. Coat color ranges from light to dark brown, often with a grayish tint intermixed. The several recognized subspecies range from New England south, through parts of Georgia and Alabama, and into the Midwest. Woodchucks are, for the most part, absent from states west of the Great Plains but do range north throughout much of Canada and into Alaska. The woodchuck also has several close relatives in North America, known as marmots, all of which generally inhabit alpine or high-latitude meadows.

Habits

Woodchucks adapted readily to agricultural areas with open fields and edge habitat, to their apparent great benefit. The species now colonizes suburban, and even urban, habitats, although many such presences may just be adaptive shifts after farmlands are converted to subdivisions. Burrows may be established under sheds, garages, or even houses. It is also common to see woodchucks in the grassy edges and sometimes medians of highways, where they are often left alone and find refuge from all but vehicular traffic. Woodchucks are herbivores and primarily eat grasses and forbs such as clover and dandelion. There are few studies documenting nonagricultural plants commonly eaten by woodchucks. Any gardener who has dealt with woodchucks, however, will have a long list, starting with beans and continuing on from there.

Woodchucks breed in March and April after emerging from hibernation, and the usual litters of four to six young are born about a month after mating. Woodchucks produce just one litter per year, with only about half of the young surviving to the end of their first year. The young mature rapidly; after about a month of nursing, they are weaned and emerge from the natal burrow for the first time to explore the aboveground world. Then they are usually on their own, sleeping away from home and wandering widely by midsummer. Most young disperse and establish their own territories at the end of their first summer, while one or two female young may stay and share their mother's home range during their second summer.

The burrow that a woodchuck excavates is almost as good a sign of her presence as is seeing the animal herself. Generally there is one prominent main entrance, often marked by an obvious spillway of soil dumped out front, and from one to several well-concealed back doors or "bolt holes." The dog or other animal trying to dig the woodchuck out may find she is not home after much tiring work. Burrows are often rather shallow (two to three feet deep), and the system may range from a single tunnel terminating in a chamber to a complex maze with multiple branches. Complexity probably depends on the length of occupancy and the number of woodchucks in residence. Sometimes entrances are next to a large rock or nestled among tree roots to provide support that may discourage predators from trying to dig their way in. Some burrow systems will be inhabited for decades by successive generations of woodchucks and may be occupied by many other species of wildlife, both during and between periods of woodchuck occupancy.

In fall woodchucks will find a burrow suitable for hibernation (called a hibernaculum), which may or may not be the same burrow the animal used during the summer months. Woodchucks are true hibernators and will sleep for up to five months after the onset of cold weather. The exact timing of the beginning and end of hibernation varies from year to year (except in Punxsutawney) and geographically. The woodchuck's high-elevation and high-latitude cousins remain dormant for up to eight months.

Public Health Concerns

Woodchucks are not considered to be a significant source of any infectious disease that can be transmitted to humans. They can get rabies and may be boldly aggressive when this disease has taken its final hold on them. For this reason unprovoked attacks by woodchucks must be treated very seriously as potential rabies exposures.

Problems

Woodchucks will occasionally eat garden or field crops, and in a small garden, they can cause considerable damage in a very short period (Figure 99). Because the animals hibernate, woodchuck damage is unlikely between early November and late February. Damage done during this time is more likely to be caused by deer or rabbits. Burrow systems are regarded as problems where agriculture is practiced, because farm machines can be damaged when they run over a spill mound. Similarly, many horse owners do not like to see woodchuck burrows in the paddock for fear of injury to their horses. Even the claim that people can be injured by tripping in woodchuck burrows is encountered from time to time. This is possible, we believe, but far down the list of threats to our own species.



THE HSUS

Figure 99 *A woodchuck sampled this squash before giving up and moving on to other, tastier, non-garden plants, or he might have been just a ship passing in the night to begin with. The major campaign to address this "problem" was never executed, as the gardener recognized sheepishly that a "problem" didn't even exist.*

Solutions

Tolerance

People and woodchucks can coexist for years without conflict. Where buildings have sprung up on old farmlands and woodchucks have burrows in the remnant woodlots, the only contact may be an occasional early morning or evening sighting of woodchucks grazing at lawn edges. The animals do no recognizable harm and are simply a part of the natural scene. Then one day a perennial bed or a vegetable garden suffers damage, and the presence of woodchucks becomes an issue.

To some woodchucks may be simply "vermin," unusable animals that do humans no obvious service and are thus worthy of persecution. Just the possibility that woodchucks might cause problems in the future is used as an excuse to "control" them. Woodchucks may not appear terribly useful to humans, but to the extent that urban and suburban landscapes constitute an ecosystem, the woodchuck should certainly be accepted as a part of this circle of life, even in these heavily human-altered areas. They are prey for coyotes, foxes, weasels, badgers, hawks, and eagles, and their burrows provide shelter for numerous amphibians, reptiles, smaller rodents, and even larger animals, such as foxes.

Closing Burrows

Where woodchuck burrows are deemed to be problems, eviction and exclusion are the recommended courses of action. Woodchucks can be driven from burrows by harassment or by disturbing the burrow system. Timing is everything, however. Before attempting to evict and exclude woodchucks, think about when you will act. Since breeding female woodchucks have dependent young in their burrows from late winter until spring or early

summer, it would be inhumane to try to get them to give up their burrows during this time. Females will resist abandoning young, even under great duress. But wait too late in the year, and you will impede winter survival, which means putting on weight and securing a suitable hibernaculum to sleep away the season. Adult woodchucks, therefore, may be especially hard to budge in the fall.

The best time to try evicting woodchucks from burrows is from mid- to late summer, or between early July and late September in most areas. If you watch closely, you may actually see the young woodchucks as they first venture above ground; if you do you can time your woodchuck eviction to begin about three weeks later with relative assurance that it will avoid affecting dependent offspring.

Start by testing for activity. Loosely fill all of the burrow entrances (use grass clippings, newspaper, or similar material) and monitor activity to determine if the burrow is currently vacant. Remember that several exits may be present in a given burrow system, and all should be located and plugged. If, after three to five days in good summer weather, the material has not been disturbed, the burrow can be assumed to be unoccupied and permanently closed. Heavy-gauge, welded fencing wire (with no larger than three-inch squares) is recommended to close burrows. Cut the wire into about three-square-foot sections. Then center a section over each burrow entrance and bury it at least one foot deep, pinning it down if necessary with landscape staples.

If the burrow system is occupied, harass the residents by partially digging the entrance out. Clear vegetation away from entrances and put some benign but strong-smelling substance just inside the entrance (we have had success with urine-saturated clumps of kitty litter), then loosely seal the entrance so the smell stays inside the burrow. Monitor the closed burrow every few days to make sure it is not still occupied; when it is clear that the burrow is empty, a permanent seal can be provided.

Fencing may be needed to protect gardens. Fences work best when protecting relatively small areas. Woodchucks are good climbers as well as diggers, something to keep in mind when designing and building a fence. A perimeter garden fence should be made of a chicken or welded wire with mesh size no bigger than three by three inches. It should be three to four feet above ground level, and the woodchuck should not be able to dig under it (an L-footer that is buried or pinned to the ground or a single strand of electric fencing four inches off the ground and six inches in front can help prevent this). The key to a successful fence is to leave a good twelve to eighteen inches at its top unsecured so it will wobble back and forth as the woodchuck climbs up to it. The feeling of insecurity often (based on admittedly anecdotal feedback) discourages the woodchuck from climbing.

If you want to put up a more rigid fence, bend the top ten to fifteen inches outward at a 45-degree angle to create a barrier to help prevent climbing. Electric fences will work as well, and often the simple single strand of electrified wire about four inches from the ground is enough to discourage visits. If not, an additional strand can be rigged at about nine inches in height. (All of the precautions with using electric fences apply, of course.)

Scare Devices

Woodchucks are cautious animals. Novel stimuli, such as a scarecrow or a beach ball left to move with the wind across an open area, may keep them out temporarily. These scare devices are more likely to work if they are changed frequently. Before going to any greater trouble or expense, you may want to buy a couple of silvery Mylar® helium balloons at your local party store and tether them in the garden on a two- to three-foot line, so the wind can bounce them onto the ground occasionally. This may frighten exploring woodchucks away, not to mention birds you may want to keep out as well.

Habitat Modification

Woodchucks like to have fairly high vegetation to move around as both approach and escape cover. Removing vegetation around burrows can create insecurity and, with other eviction methods applied simultaneously, can encourage them to abandon a burrow system—especially one that has not been used for long. Beyond that, mowing to keep undergrowth and grass cover low may deny woodchucks the security they would like to start burrowing around buildings and residences.

During the course of the year, woodchucks move between burrow systems a lot as part of their normal routine. Frequently a burrow is abandoned or unoccupied for weeks, or even months, before it is reopened. A highly developed sense of smell allows woodchucks to locate places where others have lived months (and maybe years) after the occupants have left, even when the entrance is barely recognizable as such. It's only a few minutes' work for the average woodchuck, and the tunnel system is open and usable again; this is why we recommend burying the three-foot-square panel of welded wire, centered over the entrance hole.

Repellents

There are no commercial repellents registered for use on woodchucks.

A Last Word

It is a paradox that we make a celebrity of one woodchuck over a fictitious relationship between shadows and seasons and a villain of another a few weeks later over garden vegetables. There are ways to deal with woodchucks that make it possible to live more or less in harmony with them, even when the potential for conflict is high. In places or at times when woodchucks must be evicted from an area, recognize that this is only a first step, to be followed by managing the factors that caused a problem in the first place. What exactly these factors are remains to some extent to be better studied—or studied at all, given the low priority of understanding how to live in harmony with this planet's living communities.

Resources

Woodchucks have been the object of dozens of university extension bulletins, most of which encourage lethal control. As is the case with voles and other species, good books about living in harmony remain to be written.



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WOODPECKERS



Figure 100 *Acorn woodpecker*

WOODPECKERS RARELY engage in activities that bring them into conflict with humans, but when they do, it can be quite newsworthy (Figure 100). In 1995 a pair of woodpeckers famously delayed launch of the space shuttle *Discovery* after drilling almost two hundred holes in the foam insulation of the shuttle's external propellant tank. Less expensive but more frequent conflicts involve drumming and feeding on wood-sided houses. Some people are driven to distraction, understandably, when that familiar rat-a-tat hammering emanates from the side of their house in the early morning hours and continues every day for what seems to (and sometimes even can) stretch into weeks. Nerves are frayed, tempers are roused, and the homeowner becomes desperate for the activity to stop. The federal laws that protect woodpeckers and most other birds mean that they can only be killed under a special permit, and even the launch of the space shuttle had to comply with the rules. Besides, nonlethal methods work in almost every case and probably only fail when people are unwilling to expend any effort. The key to resolving problems with woodpeckers humanely and effectively is to act early.

- **With their unusually long tongues, which are sticky as well as barbed, woodpeckers are able to extract insects from tiny holes and crevices in trees.**
- **The special anatomical structures that prevent brain injury when woodpeckers drill wood could provide insight some day into protecting humans from head injuries.**
- **In many species male woodpeckers may be distinguished from females by a red or yellow head patch.**

Classification and Range

There are twenty-two species of woodpeckers in the United States, although one of these (the ivory-billed) is either the rarest bird in North America or is no longer to be found, and another (the red-cockaded) remains on the critically endangered list. Most woodpeckers are year-round residents, but a few, notably the sapsuckers, are migratory. Woodpeckers are members of the family *Picidae*, and all species share certain characteristics that are well suited to their remarkable lifestyle. Their bills and tongues are adapted to drilling and probing under tree bark, while their strong claws and stiff tailfeathers help prop them up on the tree trunks or branches they work. Their skulls have special sacs that cushion the brain from impact, while the tongue of most woodpeckers wraps around the skull and enables them to probe deep into the cavities of trees and dead wood. Even the fine feathers around their nostrils help by filtering wood dust.

Each species of woodpecker has distinctive markings and is found within a defined geographic range. A field guide is invaluable in distinguishing among field marks and plumages. Twelve species are most likely to be in conflict with humans. In the East and Midwest, these include the redheaded woodpecker (*Melanerpes erythrocephalus*), the red-bellied woodpecker (*M. carolinus*), the pileated woodpecker (*Dryocopus pileatus*, which also ranges into Western Canada and parts of the Pacific Northwest), and the yellow-bellied sapsucker (*Sphyrapicus varius*). The Western forms include the acorn woodpecker (*M. formicivorus*), the golden-fronted woodpecker (*M. aurifrons*), the ladder-backed woodpecker (*Picoides scalaris*), and Williamson's sapsucker (*Sphyrapicus thyroideus*). The downy woodpecker (*P. pubescens*), the smallest and most common woodpecker in the United States and a close look-alike, the hairy woodpecker (*P. villosus*), along with the Northern flicker (*Colaptes auratus*), are widely distributed both east and west (Figure 101).

Habits

Woodpeckers occupy a variety of niches in the natural world. Lewis's woodpecker, for example, behaves like a flycatcher, darting from its perch to catch flying insects, a behavior called "hawking." The northern flicker feeds on the ground, probing the soil for insects. Sapsuckers feed on the sap (and insects trapped therein) flowing from the orderly rows of small holes they drill in trees. Most woodpeckers are residents of mature open woodlands and do a majority of their foraging on dead or dying trees.

Woodpeckers feed primarily on wood-boring insects, which they can dig out with their powerful beaks. Some will consume other prey such as gypsy moths, tent caterpillars, and grasshoppers. A few favor a diet primarily of plant material, such as nuts, fruit, berries, or tree sap. The acorn woodpecker even caches food for winter by pounding



Figure 101 *Flicker*

acorns into small holes excavated in trees. Many woodpeckers are readily attracted to bird feeders stocked with sunflower seeds, and suet is a preferred food often used to attract these birds in winter.

Woodpeckers also use their beaks to excavate cavities in trees for nesting sites. Depending on the species, nests may be up to two feet deep beneath the entry hole. Both parents usually help to dig the nest cavity and care for the young. Old nests are often appropriated by other species of birds or mammals for their own shelter. In spring woodpeckers lay between four and six eggs, which are incubated for about two weeks, and raise their young in their nest cavities. Woodpecker nestlings will fledge from the nest after twenty to twenty-eight days.

Public Health Concerns

Woodpeckers are not considered to be a source of any infectious disease that can be transmitted to humans.

Problems

Problems with woodpeckers are most likely to occur in the spring, with most damage falling into three categories: drumming, feeding, and nest-building. Many species rhythmically "drum" on resonating objects as a territorial advertisement, similar to birdsong. Occasionally drumming "stations" are set up on utility poles, gutters, chimney caps, and other places on buildings with good resonance. Drumming is typically concentrated in one area of the building and occurs persistently. Damage generally consists of shallow, clustered pockmarks or dents, rather than the deeper holes associated with feeding and nesting. The sound of drumming tends to be more annoying than visibly damaging. Woodpeckers feed on wood-sided buildings when insect larvae are present. They may establish a feeding pattern on a house and be very persistent in seeking larvae there.

Woodpeckers also excavate cavities for nesting and roosting. These holes are round and deep—some species excavate as far as two feet into trees. Any number of half-finished holes may appear on a structure as woodpeckers often discard a start at cavity building that, for reasons known only to them, does not seem promising.

Solutions

Tolerance

While a property owner may be quite frustrated by attacks on siding or by other woodpecker activity around the house, the benefit and enjoyment people derive from the presence of these birds certainly outweigh any damage or inconvenience they cause. Any problems a woodpecker may cause should be addressed immediately and solved with nonlethal methods.

Scare Devices

When woodpeckers attack houses, for whatever reason, it is imperative to take immediate steps to deter them. We recommend that homeowners with incipient woodpecker problems try to scare or mildly harass the birds by shouting, clapping, banging on a pot, or squirting water from a hose near, but not at, the birds. It is necessary to be persistent with these strategies, but they often can prove successful.

A number of commercially available products can be used to scare or aversively condition the birds at this early stage, as can homemade standbys such as wind chimes, aluminum pans, and plastic streamers. The least expensive alternatives should be tried before going to greater trouble and expense. Hanging strips of aluminum foil, scare tape, or cloth that flutters in the wind from the eaves may frighten the offending bird off. Inexpensive scare balloons or Mylar® party balloons can be used for the same purpose, hung or suspended in the area immediately around where the woodpecker is active. Woodpeckers may just shift their activity to another part of the house, however, and it is important to remain vigilant to this possibil-

ity. Of the types of scare tape available, our favorite is embossed with holographic images, which reflect light in a dazzling array of points and colors. Tape should be suspended from eaves or nearby tree branches, again, as close to where damage is occurring as possible, and allowed to move with the wind. Mount several tape strands parallel to one another, two to three feet apart.

Prevention: Drumming

A simple first step in discouraging drumming is to secure loose boards or to use filling behind boards that sound hollow. Chimney caps may be covered with cloth or foam rubber padding until the habit is broken, taking care not to block the screen but to cover the metal flashing, which is typically where drumming occurs. It may be possible to hang netting, plastic sheeting, or screen from the eaves and suspend it several inches from the wall woodpeckers are attacking to deter them. When exterior panels must be replaced, it may be helpful to add additional insulation to deaden resonance.

Prevention: Feeding

The root cause of the problem with woodpeckers feeding on houses is insect infestation, and the birds may be doing the homeowner a favor by drawing attention to it. It may be necessary to hire a professional exterminator to deal with the insects. After the insects are controlled, the damaged siding should be repaired or replaced.

Discouraging Nesting

Nest cavity excavation may be the most difficult problem to control. One thing to keep in mind is that building a nest or roosting cavity is a seasonal behavior pattern, and if the bird can be discouraged from this activity for even a few days, he is likely to abandon attempts at this location because of the urge to finish the nesting cycle. It is important to be alert to the onset of nesting activity then, and to remember that the same bird(s) may return next year. Prompt repair of any damage as it occurs is important. Shallow holes can be repaired quickly with caulking or wood filler, usually available from building suppliers in a variety of matching colors. Larger holes (make sure no birds are inside) may be filled with wooden plugs or wadded window screen and then caulked. While repairing holes, also caulk any loose knots that may be in the area. Small-mesh hardware cloth or welded wire can also be used to cover damaged areas and protect them from further damage.

Habitat Management

Some homeowners leave dead trees standing as habitat for wildlife, taking down only as much of the limb structure as might be hazardous to people. Perhaps giving woodpeckers such habitat can encourage them not to "misbehave" on the house siding—we don't know. But clearly leaving such "snags" would benefit these birds as well as others. There are nest boxes designed to attract woodpeckers, and we would also certainly offer one to the woodpeckers as an alternative if they are showing interest in the house.

Repellents

No chemical has been found to deter woodpeckers from human-made structures. Some claim that treating wood siding with wood preservatives containing pentachlorophenol has a repelling effect, but this has not been rigorously tested.

A Last Word

For every species we feel there are lasting, humane, and environmentally responsible approaches to resolving conflicts without hurting or killing the animals involved. With woodpeckers, it is easier to mobilize public support for humane solutions, and there are very tough laws that punish those who don't use them. Why this isn't so for every species is an interesting question and probably worth a book unto itself.

Resources

There are many books about woodpeckers, and we will play no favorites here. These animals have a special interest for people, and we devote many resources to them. As for Web-based information, the Cornell Laboratory of Ornithology (*http://birds.cornell.edu*) is a good place to start.

Afterword

TEN YEARS IS PERHAPS TOO LONG to have waited between editions of this book. Change comes quickly with respect to our understanding and tolerance of urban wildlife. In the first edition we did not predict that conflicts with Canada geese would become a national issue or that a clamor over growing deer populations would lead communities to hire sharpshooters to kill them by the hundreds. Perhaps we should have moved sooner to call attention to these issues.

On the other hand, ten years has been almost nothing when looked at from an ecological perspective. Whether deer will have lasting effects on forests or goose populations will continue to expand before natural controls exert a braking pressure on them can barely be asked in that time, let alone answered.

Ten years *is* a very long time in the life of a child. What have we taught our ten year-olds about living in harmony with the world? If they grow up watching people shoot deer from tree stands in the backyard or round up geese and gas them in improvised chambers attached to pickup trucks, they may feel this is the world as they should come to accept it. The jury is out on that account, but it may not be for long. Perhaps the greatest challenge we face in learning to live in harmony with our wild neighbors is preventing those who will succeed us from losing contact with the natural world. It is vital that we share and pass on to them the understanding, acceptance, and tolerance that will lead them to harmonize their lives with their wild neighbors.

Appendix A: Sources of Information

Since *WILD NEIGHBORS* was first published, the amount of information on urban wildlife has grown exponentially, particularly with respect to what can be found through the Internet. This is something of a blessing and something of a curse, since information on problem solving is not only much more comprehensive now, but also much more difficult and time-consuming to digest. We list below a few of the many resources available for those interested in finding out more about urban wildlife in general, accessing agencies that deal with wildlife, or learning about the many different approaches and philosophies that exist with respect to this growing area of interest.

The fact that we list resources that do not always subscribe to the humane approach as we see it does not mean that we endorse or condone them. We feel people deserve an opportunity to better educate themselves about some of the alternative ways in which the issues have been considered. Education, even with respect to competing and alternative viewpoints, is still the fundamental and critical basis for the humane approach.

First Stop

General information on The HSUS can be found at our main website: *www.humanesociety.org*. The urban wildlife program can be located at: *www.humanesociety.org/wildneighbors*. For information on our Wildlife Land Trust, visit us at: *www.wlt.org* or call 1-800-729-SAVE.

HSUS Regional Offices

The HSUS's regional offices are able to assist anyone involved in a wildlife issue that encompasses community concerns or action. With their regional and state-specific staffers, these offices handle animal-related issues ranging from animal abuse to information on local humane societies to wildlife regulations, to help you make the right connections. Look for information on regional programs and issues on *www.humanesociety.org* by typing "regional office" in the search box.

Reading for Pleasure

In the first edition of *Wild Neighbors*, we tried to identify some of the more prominent sources and references for urban wildlife-control techniques and strategies. This time we thought we'd recommend some of the popular, nontechnical literature on urban wildlife to give those of you who just want to enjoy reading about this subject some idea of the richness of the resources available. We've also added a few offbeat references that have come to our attention since the first edition, including (unknown to us at the time) a book entitled *Wild Neighbors* that was published in 1899.

Adams, Lowell. 1994. *Urban Wildlife Habitats*. Minneapolis: University of Minnesota Press.

Baines, Chris. 1986. *The Wild Side of Town*. London: BBC Publications and Elm Tree Books.

Beebe, William. 1953. *Unseen Life of New York: As a Naturalist Sees It*. New York: Duell, Sloan, and Pearce.

Bosselaar, Laure-Anne, ed. 2000. *Urban Nature: Poems about Wildlife in the City*. Minneapolis: Milkweed Editions.

Burger, Joanna. 1999. *Animals in Towns and Cities*. Dubuque, Iowa: Kendall/Hunt Publishing Co.

Couturier, Lisa. 2005. *The Hope of Snakes: And Other Tales from the Urban Landscape*. Boston: Beacon Press.

Dixon, Terrell F., ed. 2002. *City Wilds: Essays and Stories about Urban Nature*. Athens, Ga.: University of Georgia Press.

Dollman, Ruth. 1908. *Nature near London*. London: Chatto and Windus.

Dubkin, Leonard. 1947. *Enchanted Streets*. Boston: Little, Brown and Company.

———. 1955. *The Natural History of a Yard*. Chicago: Henry Regency.

———. 1972. *My Secret Places: One Man's Love Affair with Nature in the City*. New York: David McKay Company, Inc.

Friederici, Peter. 1999. *The Suburban Wild*. Athens, Ga.: The University of Georgia Press.

Fritter, R.S.R. 1945. *London's Natural History*. London: Bloomsbury Books.

Garber, Steven D. 1987. *The Urban Naturalist*. New York: John Wiley and Sons.

Goode, David. 1986. *Wild in London*. London: Michael Joseph Ltd.

Halle, Louis J. 1947. *Spring in Washington*. Baltimore: Johns Hopkins University Press.

Headstrom, Richard. 1984. *Suburban Wildlife*. Englewood Cliffs, N.J.: Prentice-Hall, Inc.

Holingue, Scott. 1994. *Tales from an Urban Wilderness*. Evanston, Ill.: Chicago Historical Bookworks.

Holmes, Hannah. 2005. *Suburban Safari: A Year on the Lawn*. New York: Bloomsbury Publishing.

Houck, Michael C., and M.J. Cody. 2000. *Wild in the City: A Guide to Portland's Natural Areas*. Portland: Oregon Historical Society Press.

Ingersoll, Ernest. 1899. *Wild Neighbors: Outdoor Studies in the United States*. New York: The Macmillan Company.

Jenkins, Alan C. 1982. *Wildlife in the City: Animals, Birds, Reptiles, Insects, and Plants in an Urban Landscape*. Exeter, England: Webb and Bower.

Johnson, Walter. 1930. *Animal Life in London*. London: The Sheldon Press.

Kieran, John. 1959. *A Natural History of New York*. Boston: Houghton Mifflin Company.

Kinkead, Eugene. 1974. *A Concrete Look at Nature*. New York: Quadrangle/The New York Times Book Co.

———. 1978. *Wildness Is All around Us*. New York: E.P. Dutton.

Knowler, Donald. 1984. *The Falconer of Central Park*. Toronto: Bantam Books.

Landry, Sarah B. 1994. *Peterson First Guide to Urban Wildlife*. Boston: Houghton Mifflin Company.

Lesaffre, Guilhem. 1997. *Wildlife of the Town*. London: HarperCollins.

Long, Kim. 1995. *Squirrels: A Wildlife Handbook*. Boulder, Colo.: Johnson Books.

Matthews, Anne. 2001. *Wild Nights: Nature Returns to the City*. New York: North Point Press.

McLoughlin, John C. 1978. *The Animals among Us*. New York: The Viking Press.

Mitchell, John Hansen. 1985. *A Field Guide to Your Own Back Yard*. New York: W.W. Norton and Co.

Mittelbach, Margaret, and Michael Crewdson. 1997. *Wild New York: A Guide to the Wildlife, Wild Places, and Natural Phenomena of New York City*. New York: Crown Publishers, Inc.

Moorhead, Carol Ann. 1992. *Backyard Wildlife: A Natural History, Ecology, and Action Guide to Front Range Urban Wildlife*. Niwot, Colo.: Roberts Rinehart Publishers.

Peterson, Russell. *Another View of the City: A Chronicle of a Heritage Besieged*. New York: McGraw-Hill Book Company.

Pyle, Robert Michael. 1993. *The Thunder Tree: Lessons from an Urban Wildland*. Boston: Houghton Mifflin.

———. 1996. *Wintergreen: Listening to the Land's Heart*. Boston: Houghton Mifflin.

Ricciuti, E.R. 1984. *The New York City Wildlife Guide*. New York: Nick Lyons Books.

Rinehart, Frederick R., and Elizabeth A. Webb, eds. 1990. *Close to Home: Colorado's Urban Wildlife*. Boulder, Colo.: Denver Museum of Natural History.

Rood, Ronald. 1977. *Possum in the Parking Lot*. New York: Simon and Schuster.

Rublowsky, John. 1967. *Nature in the City*. New York: Basic Books, Inc.

Russell, Helen Ross. 1975. *City Critters*. Cortland, N.Y.: The American Nature Study Society.

Sabloff, Annabelle. 2001. *Reordering the Natural World: Humans and Animals in the City*. Toronto: University of Toronto Press.

Shirley, Peter. 1996. *Urban Wildlife*. London: Whittet Books, Ltd.

Swanson, D. 1995. *Coyotes in the Crosswalk*. Stillwater, Minn.: Voyageur Press.

Vessel, Matthew F., and Herbert H. Wong. 1987. *Natural History of Vacant Lots*. Berkeley: University of California Press.

Villard, Paul. 1975. *Wild Animals around Your Home*. New York: Winchester Press.

Watkins, William Jon. 1981. *Suburban Wilderness*. New York: G.P. Putnam's Sons.

Whipple, A.B.C. 1994. *Critters: Adventures in Wildest Suburbia*. New York: St. Martin's Press.

Wilson, Jane, ed. 1991. *Victorian Urban Wildlife*. New Zealand: HarperCollins Publishers.

Wilson, Ron. 1983. *The Urban Dweller's Wildlife Companion*. Poole, Dorset, England: Blanford Press.

Newsletters and Periodicals

The *Urban Open Space Manager* newsletter is published quarterly by Urban Wildlife Resources, Columbia, Md.; 410-997-7161, *http://users.erols.com/urbanwildlife/openspace.htm*. Available by subscription at $15 per year.

Urban Nature magazine is published by Urban Environment, Birmingham, England. Contact the publisher for up-to-date subscription prices. Telephone +44 121-428-2462. (Within the United Kingdom: 0121-428-2462.) *http://members.aol.com/UrbanEnvt/welcome.htm*; urbanenvt@aol.com.

The National Wildlife Federation publishes the *Conservation Directory and Backyard Habitat Program* newsletter. The Conservation Directory, searchable online at *www.nwf.org/conservationdirectory/*, is the most comprehensive guide to government, state, and private organizations that deal with conservation issues. The Backyard Wildlife Program of the NWF is a long-standing series of resources that encourages people to enhance the value of their yards for wildlife. Contact NWF at 202-797-6800 or visit *www.nwf.org*.

Federal Agencies

U.S. Environmental Protection Agency, Pesticide Programs

National Pesticide Information Center: 800-858-7378, *www.epa.gov/pesticides/*.

U.S. Department of Agriculture Animal and Plant Health Inspection Service (APHIS-ADC) Wildlife Services, Washington, D.C. 866-4USDA-WS (4873-297), *www.aphis.usda.gov/ws/*.

National Wildlife Research Center, Ft. Collins, Colo., 970-266-6000.

Cooperative Extension System offices. This webpage provides links to find USDA Cooperative Extension offices in each U.S. state and territory. *www.csrees.usda.gov/Extension/index.html*.

U.S. Department of the Interior, U.S. Fish and Wildlife Service Washington, D.C., 800-344-WILD(9453), *www.fws.gov*.

Links to U.S. state and territorial wildlife agencies can be found at this page of USFWS's website: *www.fws.gov/offices/statelinks.html*.

Wildlife Rehabilitation

National Wildlife Rehabilitators Association, Cloud, Minn., 320-230-9920, nwra@wildlife.org, *www.nwrawildlife.org*.

International Wildlife Rehabilitation Council, San Jose, Calif., 408-271-2685, office@iwrc-online.org, *www.iwrc-online.org*. The IWRC maintains an international directory of wildlife rehabilitators that can be accessed directly at:

www.wildlife-international.org/EN/public/emergency/emergencyrehab.html.

Another site that lists rehabilitators is: *www.tc.umn.edu/~devo0028*.

Instructions for making a raptor perch can be found at: *www.inhs.uiuc.edu/~kenr/birdperchinstruct.html*.

Appendix B

Retail Sources for Products to Resolve Wildlife Conflicts

This appendix suggests sources for products used in nonlethal wildlife conflict resolution that have been discussed in other sections of this book. *No endorsement of specific brands, companies, or product lines by The Humane Society of the United States is implied or intended by inclusion here or reference elsewhere in the book*. We suggest where to find products, including names and contact information for providers of some products, that are deemed humane and that can be appropriate in nonlethal animal control under proper circumstances.

Although the list is not complete, we have included suggestions for the types of merchants to check for commonly available products and specific vendors who, at the time of publication, sold less commonly available or specialized products. Since publication of the first edition of *Wild Neighbors*, Internet-based marketing has expanded significantly to the point that anyone with access to the Internet can readily search for vendors of even the most uncommon and specialized products very quickly.

Exclusion Products

Animal-Resistant Trash Containers

Bungee or Shock Cords

Check for them at home and hardware stores; marine and motorcycle suppliers; or sporting goods suppliers, especially those that sell camping, boating, biking, and climbing equipment.

Containers with Screw-on Lids

A plastic container design to exclude animals such as raccoons or, with modification, larger animals such as bears.

Animal-Resistant Can
www.animalresistantcan.com
800-914-4771

Critter Can (offers do-it-yourself instructions to find materials and make your own, plus link to a vendor selling a finished product)

www.crittercan.org
973-853-BEAR (2327)

Bear-resistant Containers

Most that claim to be "bear-proof" are sturdy metal containers with latching lids. Plastic containers above and from Bear Saver and UnBearAble Bins, below, are also sold for household trash in bear country.

Bear Proof, Inc.
www.bearproofinc.com
970-309-2460

Bear Saver
www.bearsaver.com
909-605-1697

UnBearAble Bins
www.unbearablebins.com
403-609-2242

Bafflers

Bafflers to prevent mammals such as raccoons and squirrels from getting into birdfeeders are the most widely varied and widely available products to prevent conflicts with wild animals. Look for bafflers as separate add-ons for your existing feeders or for feeders that incorporate bafflers from any of the many suppliers of feeders; home, garden, or hardware retailers as well as retailers that specialize in birdfeeding products. Bafflers to prevent predators from robbing nests in birdhouses are sold by similar merchants, particularly those who specialize in backyard bird products.

Bird Wires or Roost Inhibitors

These physically exclude birds from roosting in places they are unwelcome; include bird wire, bird spikes, bird coils, and similar devices. Small kits are sold by large catalog and Web retailers too numerous to list here who mainly market products for homes and gardens. These retailers specialize in bird control and similar products.

Bird Barrier America
www.birdbarrier.com
800-503-5444

Bird B Gone
www.birdbgone.com
800-392-6915

Birdbusters
www.birdbusters.com
800-662-4737

Bird Guard
www.birdguard.com
800-331-2973

Bird-X, Inc.
www.bird-x.com
800-662-502

Cat Claw, Inc.
www.catclaw.com
800-832-2473

Nixalite of America
www.nixilite.com
888-624-1189

Bulb Cages and Gopher Baskets

Premade gopher baskets are sold regionally where burrowers are particularly prevalent. Unfortunately, most retailers who sell these humane prevention products also sell inhumane lethal traps and poisons for the same species. Shop carefully. Premade bulb cages may be found seasonally at bulb-planting time where flower bulbs are sold and from the vendor below. Large catalog and Web retailers who mainly market products for homes and gardens also sometimes offer them.

Gardener's Supply Company
www.gardeners.com
888-833-1412

Plant Covers

Look for cloches, row covers, and garden fabric to cover young plants early in the growing season at nurseries, home, and garden suppliers.

Wire Mesh, Caulking, and Foam Sealants

A wide variety of caulking and foam sealants are sold by home and hardware retailers. The best wire mesh for excluding animals, made of copper, is a little harder to find but the sources listed offer it. To find it on the Web, try searching by the brand name "Stuf-fit" or by "copper wire mesh." It is available from some pest-control supply retailers that sell this humane prevention product, along with inhumane lethal traps and poisons. Shop carefully, check these vendors, or contact the manufacturer for information on distributors.

Nixalite of America
www.nixilite.com
888-624-1189

Allen Special Products
(manufacturer)
800-848-6805

Chimney Caps

Caps are widely available from home and hardware suppliers and from chimney sweeps.

Fencing

Apron or L-Shaped Fences/Barriers

Keystone Steel and Wire Co.
(check website or call for distributor)
www.redbran.com
800-447-6444

Louis E. Page
www.louispage.com
800-225-0508

Coyote Roller

Roll Guard, Inc.
www.coyoteroller.com
619-258-2600

Light- to Medium-duty Fencing

Sold mainly as deer fencing in a variety of gauges and sizes, it is widely available from garden suppliers and nurseries as well as these vendors.

Benner's Gardens
www.bennersgardens.com
800-244-3337

Deer-Resistant Landscape Nursery
www.deerresistentplants.com
800-595-3650

Gardener's Supply Company
www.gardeners.com
888-833-1412

Kencove Farm Fence, Inc.
www.kencove.com
800-536-2683

Keystone Steel and Wire Co.
(check website or call for distributor)
www.redbrand.com
800-447-6444

Louis E. Page
www.louispage.com
800-225-0508

High-tensile Nonelectric Fencing

This staple of agricultural fencing that uses either multiple smooth wires or woven wire installed under tension to make a strong barrier for large animals is widely available from farm suppliers, including these.

Kencove Farm Fence, Inc.
www.kencove.com
800-536-2683

Keystone Steel and Wire Co.
(check website or call for distributor)
www.redbrand.com
800-447-6444

Max-Flex Fence Systems
www.maxflex.com
800-356-5458

Hardware Cloth and Welded Wire

These staples of home maintenance and do-it-yourself projects are readily available from just about any hardware and home improvement retailer.

Netting

This versatile product is widely available from home and garden supply retailers and nurseries, especially during the planting and growing season, and from specialized retailers of bird and deer-control products and backyard pond products year-round.

One-way Doors (Animal Excluders)

These are modified from live-trap designs and, therefore, are sold by trap retailers. They can be found from some pest-control supply retailers that sell this humane product, along with inhumane lethal traps and poisons.

Shop carefully. Here are two retailers that offer excluders.

Pet Warehouse Superstore
www.petsafe-warehouse.com
407-349-2525

Tomahawk Live Trap Company
www.livetrap.com
800-272-8727

Vent Covers

These covers are readily available from stores, catalogs, and Web retailers that sell products for homes.

Tree Protectors

These are sometimes sold by garden suppliers and nurseries, particularly during planting season. This specialty vendor offers them to the public.

Treessentials Company
www.treessentials.com
800-248-8239

Window Well Covers

Find these at home and hardware suppliers for do-it-yourselfers or have a window contractor install.

Aversive Conditioning

Acoustical Alarms

Shop carefully to distinguish between these effective alarms and similar-looking ultrasonic products, discussed in chapter 8, often marketed with very similar claims. Look for alarms by searching the Web for the brand name Critter Gitter, check home improvement and pet retailers, or check these.

Amtek
www.amtekpet.com
800-762-7618

Margo Supplies, Ltd.
www.margosupplies.com
403-652-1932

Bird Distress Calls

Bird Barrier America
www.birdbarrier.com
800-503-5444

Birdbusters
www.birdbusters.com
800-662-4737

Bird Guard
www.birdguard.com
800-331-2973

Bird-X, Inc.
www.bird-x.com
800-662-5021

Margo Supplies, Ltd.
www.margosupplies.com
403-652-1932

Nixalite of America
www.nixilite.com
888-624-1189

Pet Warehouse Superstore
www.petsafe-warehouse.com
407-349-2525

Reed-Joseph International
www.reed-joseph.com
800-647-5554

Effigies, Scarecrows, and Kites

Simple, stationary effigies and scarecrows (those least likely to work) are sold by many vendors, too numerous to list here.

Electric Shock

Electric Fencing

High-tensile fences are frequently electrified to exclude large wildlife species, especially deer, but also bear and predators. They are widely available from farm suppliers, including these.

ElectroBraid Fence Ltd.
(check website or call for distributor)
www.electrobraid.com
888-430-3330

Gallagher Animal Management Solutions
(check website or call for distributor)
www.gallagherusa.com
800-531-5908

Kencove Farm Fence, Inc.
www.kencove.com
800-536-2683

Max-Flex Fence Systems
www.maxflex.com
800-356-5458

Premier 1 Supplies
www.premier1supplies.com
800-282-6631

Zareba Systems
(check website or call for distributor)
www.zarebasystems.com
800-272-9877

Electric Fencing Kits for Home Gardens and Ponds

Look for kits for small to medium-size home gardens at nurseries and garden suppliers; look for kits for home ponds at suppliers of home pond products; or check these vendors.

Fi-Shock, Inc.
(check website or call for distributor)
www.fishock.com
800-251-9288

Pet Warehouse Superstore
www.petsafe-warehouse.com
407-349-2525

Zareba Systems
(check website or call for distributor)
www.zarebasystems
800-272-9877

Electric Shock Deer Posts

A set of posts sold by numerous nurseries and garden suppliers, including these, eliminates the fence wires entirely.

Gardener's Supply Company
www.gardeners.com
888-833-1412

Wireless Deer Fence
www.wirelessdeerfence.com
866-GOT-DEER (468-3337)

Electric Shock Track or Wires for Birds

These electrified tracks can be installed professionally, similar to nonelectrified bird wires.

Bird Barrier America
www.birdbarrier.com
800-503-5444

Bird B Gone
www.birdbgone.com
800-392-6915

Birdbusters
www.birdbusters.com
800-662-4737

Scare Balloons

This standby for deterring unwelcome wild animals is widely available from home, hardware, and garden retailers, and from the vendors listed for other bird-related products in this appendix.

Scare Tape

This standby product is also widely available from home, hardware, and garden retailers, and from the vendors listed for other bird-related products in this appendix.

Sprinklers

Motion-activated sprinklers are sold by many home, hardware, and garden retailers as well as these vendors.

Bird B Gone
www.birdbgone.com
800-392-6915

Bird-X, Inc.
www.bird-x.com
800-662-5021

Contech
www.scatmat.com
800-767-8658

Nixalite of America
www.nixilite.com
888-624-1189

Pet Warehouse Superstore
www.petsafe-warehouse.com
407-349-2525

Lights and Lasers

Strobe Lights

Some acoustical alarms (above) incorporate strobes. Inexpensive strobe lights are sold by many home gadget retailers. The vendors listed below sell larger, more expensive units for either roosting birds or squirrels in attics.

Bird-X, Inc.
www.bird-x.com
800-662-5021

Evictor Products
www.squirrelevictor.com

Pet Warehouse Superstore
www.petsafe-warehouse.com
407-349-2525

Lasers

Use only lasers made and sold specifically for bird harassment to scare some bird species, including geese and crows, from night roosting areas.

Birdbusters
www.birdbusters.com
800-662-4737

JWB Marketing
www.birdcontrolsupplies.com
800-555-9634

Margo Supplies, Ltd.
www.margosupplies.com
403-652-1932

Reed-Joseph International
www.reedjoseph.com
800-647-5554

SEA Technology
www.shopseatech.com
888-732-2246

Chemical Repellents

Repellents, especially deer repellents, are very widely available from garden supplies stores, plant nurseries, home and hardware stores, catalogs, and Web retailers. Repellent vendors are so numerous that listing them would make a book in itself. Shop carefully to distinguish predator urine (discussed in chapter 6) from other products, since they are frequently sold together with similar labeling and marketing claims. Listed here are sources for a few repellents that are harder to find.

Anthraquinone Goose Repellent

SePRO Corporation
(check website or call for
referral to local applicator)
www.flightcontrol.com
877-554-3373

Methyl Anthranilate Bird Repellent for Fogging

While many vendors of bird-control products sell the repellent alone, this vendor offers both the repellent and the fogging equipment.

Nixalite of America
www.nixilite.com
888-624-1189

Population Control

OvoControl Bird Contraceptive

As of 2007 this product was registered with the U.S. Environmental Protection Agency for Canada geese and pigeons. Registration was being sought for other birds and likely will be in place shortly. Contact the vendor for specific, up-to-date information.

Innolytics, LLC
www.hatchcontrol.com
858-759-8012

Live Traps

As discussed in chapter 6, trapping and relocating is often a poor choice and should be considered as a last resort in most situations. In the rare instances when live trapping is necessary, numerous suppliers offer traps in ranges of sizes for different-size species. In particular, and perhaps a sign of a positive trend, many retailers now offer live mouse traps. Look for them at home and hardware stores or on the Internet, shopping carefully to avoid vendors of inhumane traps. Here are a few vendors of multiple sizes of traps as well as sources for the harder-to-find live beaver traps.

Beaver Traps

Margo Supplies, Ltd.
www.margosupplies.com
403-652-1932

Tomahawk Live Trap Company
www.livetrap.com
800-272-8727

Multiple-species Traps Sold in a Range of Sizes

Animal Care Equipment and Services (ACES)
www.animal-care.com
800-338-2237

Margo Supplies, Ltd.
www.margosupplies.com
403-652-1932

Pet Warehouse Superstore
www.petsafe-warehouse.com
407-349-2525

Tomahawk Live Trap Company
www.livetrap.com
800-272-8727

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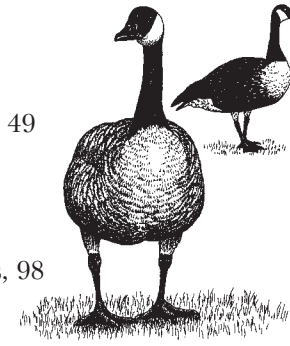
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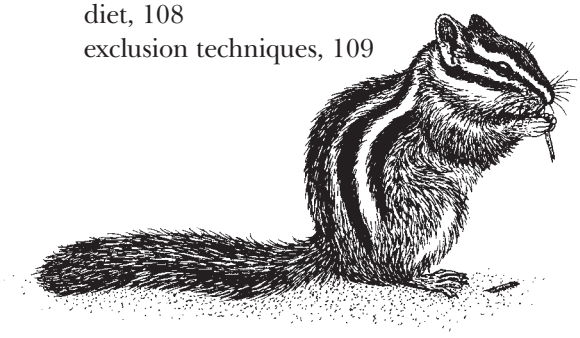
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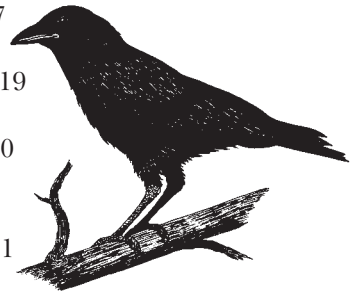
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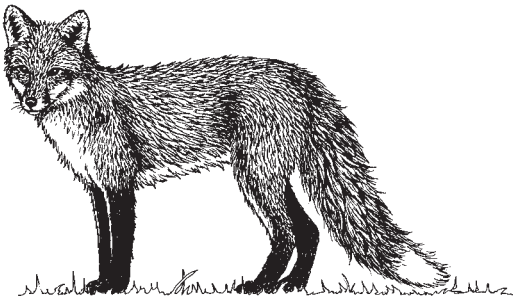
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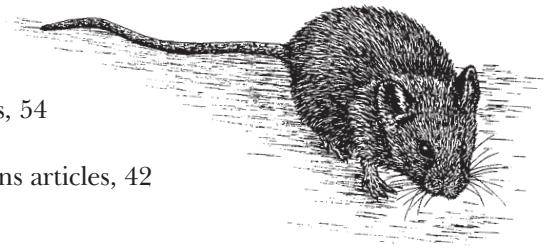
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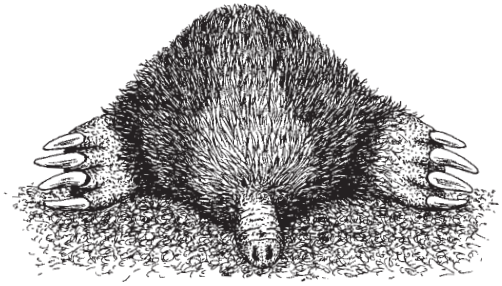
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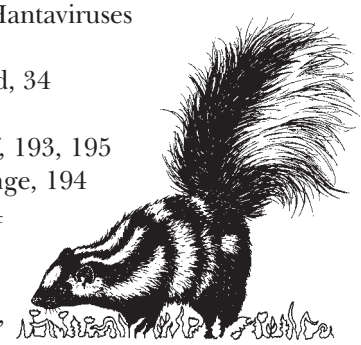


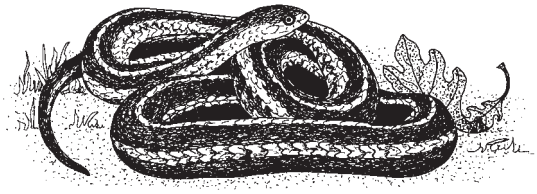
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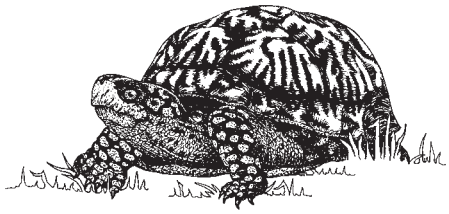
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